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Sphaerocarpos hians sp. nov., with a revision of the genus and illustrations of the species

CAROLINE COVENTRY HAYNES

(WITH PLATES 25-32)

While studying a remarkable *Sphaerocarpos* from the state of Washington, under the direction of Dr. Marshall A. Howe, the writer became gradually acquainted with the other species of this genus of Hepaticae. In the course of this study a considerable amount of material has been available and it has thus been possible to figure and describe all of the known species of *Sphaerocarpos*. The previous literature relating to the genus, especially the works of Nees von Esenbeck, Professor D. H. Campbell, Dr. Howe, and Professor Charles Douin, has been freely consulted and drawn upon. It is hoped that the information thus brought together and the conclusions drawn from it may be of some service to future students of the genus. For living material I am indebted to Professor C. Massalongo, of Ferrara, Italy, and to Professor Francis E. Lloyd, of Auburn, Alabama; freshly collected specimens, also, I owe to the kindness of Professor R. S. Cocks, of New Orleans, Louisiana. Through the courtesy of Monsieur Hariot, I was enabled to examine an authentic specimen of *S. stipitatus* from the herbarium of the Muséum d'Histoire Naturelle of Paris, our illustrations of this species being drawn from it. I must acknowledge, also, my obligations to Professor Douin, of Chartres, France, for numerous pockets of the two French species in various stages of development; to Dr. E. Levier, of Florence,

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Italy, for excellent specimens from Sardinia and various Italian stations. One of the last mentioned, from Florence, the home of the illustrious Micheli, the author of the name *Sphaerocarpos* and the first botanist to figure and describe one of the species of this genus, has been drawn upon to furnish illustrations of the generic type species. Mr. William E. Nicholson, of Lewes, Sussex, England, has kindly communicated an English specimen of the best known European species. In addition to those already named, one hundred and nine specimens have been examined in the following herbaria: that of the New York Botanical Garden (including those of L. M. Underwood and William Mitten), that of the Sullivant Moss Society, and that of the writer (including that of M. A. Howe).

Miss Lucy MacIntyre and Miss Julia T. Emerson have obligingly aided in making certain translations.

One of the results of this study is to exclude *S. Sphaerocarpos* (*S. terrestris* and *S. Michelii* of authors) from America, as no American specimen has been seen which seems to conform strictly to the characters of this European and possibly North African species. On the other hand, *Sphaerocarpos texanus* (*S. californicus* of authors) appears to have a very wide distribution, specimens from South America, Europe, and Mediterranean Africa being indistinguishable from those of the southern and western United States.

Stephani * gives the following seven species as belonging to the genus *Sphaerocarpos*: *S. terrestris* (Mich.) Smith, *S. Donnellii* Aust., *S. texanus* Aust., *S. Berteroi* Mont., *S. californicus* Aust., *S. cristatus* Howe, and *S. Jamesii* Aust. The last mentioned, Stephani states, was known to him by name only, a specimen being nowhere preserved, though, he adds, it was collected in Mexico. As no reference to such a species has been found in literature, and as Herr Stephani has been unable to give us any clue as to the place of origin of the name, it has been dropped from the list. *Sphaerocarpos texanus* appears to be indistinguishable from *S. californicus*, and, as *S. texanus* was published two years earlier, that name has been adopted. On somewhat similar grounds, though in this case the two names were based on speci-

* Bull. Herb. Boiss. 7 : 656, 657. 1899.

mens from the same locality, *Sphaerocarpos stipitatus* Bisch. replaces *S. Berterii* Mont. (*S. Berteroi* of Stephani's Species Hepaticarum). To the five species thus remaining from Stephani's list, a sixth, the new species from the state of Washington, alluded to at the outset of this paper, is added below.

It should be remarked, perhaps, that *Sphaerocarpos Notarisii*, Mont.* was, a few years after its publication, referred by Montagne to its proper genus *Riella*.

The species of *Sphaerocarpos* are certainly among the simplest and most interesting of the Hepaticae and the importance of the genus from the evolutionary and phylogenetic point of view is clearly set forth in the following quotation from Professor Campbell :†

"From a review of the preceding account of the Liverworts, it will be apparent that these plants, especially the thallose forms, constitute a very ill-defined group of organisms, one set of forms merging into another by almost insensible gradations, and this is not only true among themselves, but applies also to some extent to their connection with the Mosses and Pteridophytes. The fact that the degree of development of gametophyte and sporophyte does not always correspond makes it very difficult to determine which forms are to be regarded as the most primitive. Thus, while *Riccia* is unquestionably the simplest as regards the sporophyte, the gametophyte is very much more specialized than that of *Aneura* or *Sphaerocarpus*. The latter is, perhaps, on the whole the simplest form we know, and we can easily see how from similar forms all of the other groups may have developed. The frequent recurrence of the two sided apical cell, either as a temporary or permanent condition in so many forms, makes it probable that the primitive form had this type of apical cell. From this hypothetical form, in which the thallus was either a single layer of cells or with an imperfect midrib like *Sphaerocarpus*, three lines of development may be assumed to have arisen. In one of these the differentiation was mainly in the tissues of the gametophyte, and the sporophyte remained comparatively simple, although showing an advance in the more specialized forms. The evolution of this type is illustrated in the germinating spores of the Marchantiaceae, where there is a transition from the simple thallus with its single apical cell and smooth rhizoid to the complex thallus of the mature gametophyte. In its earlier phases it resembles closely the condition which is permanent in the simpler anacrogynous Jungermanniaceae, and it seems more probable that forms like these are primitive than that they have been derived by a reduction of the tissues from the more specialized thallus of the Marchantiaceae. *Sphaerocarpus*, showing as it does points of affinity with both the lower Marchantiales and the anacrogynous Jungermanniales, probably represents more nearly than any other known form this hypothetical type. Its sporogonium, however, simple as it is, is more perfect than that of *Riccia*, and if our hypothesis is correct, the Marchantiales must have been derived from *Sphaerocarpus*-like forms in which the sporophyte was still simpler than that of existing species. Assuming that this is correct, the further evolution of the Marchantiales is simple enough, and the series of forms from the lowest to the highest very complete."

"In the second series, the Jungermanniales, starting with *Sphaerocarpus*, the line leads through *Aneura*, *Pellia*, and similar simple thallose forms, to several types with more or less perfect leaves — e. g., *Blasia*, *Fossombronia*, *Treubia*, *Haplomitrium*. These do not constitute a single series, but have evidently developed independently, and it is quite probable that the typical foliose Jungermanniaceae are not all to be traced

* In De Not. Mem. R. Accad. Torino II. 1 : 343. *f. d. 1–8.* 1839.

† Campbell, D. H. The structure and development of mosses and ferns 157–159. 1905. [ed. 2.]

back to common ancestors, but have originated at different points from several anacrogynous prototypes."

"The systematic position of the Anthocerotes is more difficult to determine, and their connection with any existing forms known must be remote. While the structure of the thallus and sporogonium in *Notothylas* shows a not very remote resemblance to the corresponding structures in *Sphaerocarpus*, it must be remembered that the peculiar chloroplasts of the Anthocerotes, as well as the development of the sexual organs, are peculiar to the group, and quite different from other Liverworts. To find chloroplasts of similar character, one must go to the green Algae, where in many Confervaceae very similar ones occur. It is quite conceivable that the peculiarities of the sexual organs may be explained by supposing that those of such a form as *Sphaerocarpus*, for example, should become coherent with the surrounding envelope at a very early stage, and remain so until maturity. In *Aneura* we have seen that the base of the archegonium is confluent with the thallus, in which respect it offers an approach to the condition found in the Anthocerotes; but that this is anything more than an analogy is improbable. The origin of the endogenous antheridium must at present remain conjectural, but that it is secondary rather than primary is quite possible, as we know that occasionally the antheridium may originate superficially. In regard to the sporogonium, until further evidence is brought forward to show that *Notothylas* may have the columella absent in the early stages, it must be assumed that its structure in the Anthocerotes is radically different from that of the other Liverworts. Of the lower Hepaticae *Sphaerocarpus* perhaps offers again the nearest analogy to *Notothylas*, but it would not be safe at present to assume any close connection between the two. Of course the very close relationships of the three genera of the Anthocerotes among themselves are obvious."

"On the whole, then, the evidence before us seems to indicate that the simplest of the existing Hepaticae are the lower thallose Jungermanniales, and of these *Sphaerocarpus* is probably the most primitive. The two lines of the Marchantiales and Jungermanniales have diverged from this common ancestral type and developed along different lines. The Anthocerotes cannot certainly be referred to this common stock, and differ much more radically from either of the other two lines than these do from each other, so that at present the group must be looked upon as at best but remotely connected with the other Hepaticae, and both in regard to the thallus and sporophyte has its nearest affinities among certain Pteridophytes. The possibility of separate origin of the Anthocerotes from *Coleochaete*-like ancestors is conceivable, but it seems more probable that they have a common origin, very remote, it is true, with the other Liverworts. They may probably best be relegated to a separate class, coördinate with the Hepaticae and Musci."

Those who follow the Vienna Rules of nomenclature will scarcely be inclined to deny that the first effective post-1753 publication of the genus *Sphaerocarpos* is found in Boehmer's edition of Ludwig's Definitiones Generum Plantarum, dated 1760. Strict adherents of the "American Code," however, may discover that *Sphaerocarpos* was not here used in connection with a specific name and that it is not "associable by citation with a *previously published* binomial species." But Ludwig's reference to Micheli, the real founder of the genus, makes the application of the generic name and the type of the genus indisputable. Adanson, who appears to have been the next author to mention the genus, changing the spelling of the final syllable to *us*, meets the American requirements of effective publication no more closely than does Ludwig. The name, in the Michelian sense, appears not to have been used in the binomial form until 1792, though, meanwhile,

the name had been appropriated by Bulliard for a genus of Myxomycetes and by Gmelin for a genus of seed-plants. The Michelian genus, however, was soon generally recognized and its acceptance has been so universal that no synonyms for it are to be found in the literature of the Hepaticae. To attempt at this time to rename on account of a possible slight technical flaw a genus so adequately established by Micheli (even though overlooked by Linnaeus) would seem an act of violence to the spirit, at least, of the priority principle. It may be remarked that *-os* and not *-us* is the ending of the generic name as used both by Ludwig and by its originator Micheli, and that there are the same grounds for adopting it as in the case of *Symphoricarpos*, in which that termination has already become familiar. In fact, the retention of the *-os* ending, it would appear, has been made mandatory by both the Vienna Rules (Art. 57) and the "American Code" (Part III, Section I)

SPHAEROCARPOS (Mich.) Ludwig, Def. Gen. Pl. 501. 1760.—Mich. Nov. Pl. Gen. 4. *pl.* 3. 1729

Sphaerocarpus Adanson, Fam. Pl. 2: 14. 1763

Gametophores thallus-like, dioicous, annual, small, orbicular to oblong or cuneate, simple or finally once to several times furcate, the broad multistratose midrib passing gradually into the lateral enfolding or inflexed unistratose lobes, intercalary subapical lobes at length nearly equaling the lateral. Cells of gametophore thin-walled, quadrate to long-pentagonal and hexagonal, without trigones. Rhizoids hyaline, smooth, thin-walled, numerous. Sexual organs thickly aggregated along the midrib of dorsal surface of thallus. Antheridial plants minute, scarcely visible to the unaided eye, tinged with purple; antheridia oval, short-stalked, their involucres flask-shaped. Archegonial involucres tubular or clavate to pyriform or subglobose, sessile or long-stipitate. Calyptra ruptured early, a portion with shriveled archegonium-neck long persisting on the apex of capsule. Sporogonium consisting of a globose capsule, an obsolescent stalk, and a bulbous foot,* the last often remaining in the thallus after the detachment of the capsule. Capsule indehiscent, its wall

* The brood-bodies or gemmae mentioned by various authors, among whom Bischoff gave the best description with figure, this latter being copied by Pearson, are probably to be identified with the bulbous detached basal parts of the sporogonia, which in some species remains in thallus. The "grünlichen drüsenartigen Körper" mentioned and figured by Sprengel (Anleit. Kennt. Gewachse 318. *f.* 78. 1804) are perhaps the oil-bodies which occur here and there in the thallus of *Sphaerocarpos*.

consisting of a single layer of cells destitute of spiral, annular, or other local thickenings. Spores permanently united in tetrads with two exceptions, *S. Donnellii*, in which they become free at full maturity and *S. cristatus*, in which they separate early in the development of the sporogonium; spore-tetrads, when persistent, distinctly areolate, appearing crenulate, papillate or subechinulate in optical section; spores, when separate, compressed-tetrahedral, rounded-lenticular, or sometimes concavo-convex, areolate or cristate, in *S. Donnellii* prominently tuberculate in the basilar circumference. Accompanying the spore mother-cells are smaller starch-bearing sterile cells probably equivalent to elaters morphologically, but lacking a spiral band, these more or less shriveled and obscure at the maturity of the spores.

Type species, *Sphaerocarpos Sphaerocarpos* (Dicks.) M. A. Howe.

Key to the species of Sphaerocarpos

♀ involucre sessile or subsessile.
- Spores permanently united in tetrads.
  - ♀ involucre contracted at the apex, the diameter of its orifice much less than that of the involucre; spore-tetrad regularly areolate.
    - ♀ involucre pyriform, obovoid, or subglobose; meshes of spore-tetrad 7–15 μ in diameter, the separating ridges low except at their intersections where they are raised into very acute or acicular spicules. 1. *S. Sphaerocarpos.*
    - ♀ involucre tubular, fusiform-clavate, or rarely subpyriform; meshes of spore-tetrad 15–30 μ in diameter, the separating ridges usually high, sinuous, crenulate, or dissected, or sometimes raised to blunt spines at their intersections. 2. *S. texanus.*
  - ♀ involucre wide-mouthed, the diameter of its orifice equaling or often exceeding that of the subjacent part of the involucre. 3. *S. hians.*
- Spores separating at maturity, 85–138 μ in maximum diameter, areolate, each while united in the tetrad commonly showing a prominent protuberance about 12 μ high in middle of outer face, and after separation exhibiting a coarsely lobed basilar margin. 4. *S. Donnelli.*
- Spores separating long before maturity, 52–80 μ in maximum diameter, typically cristate, less commonly irregularly and sparingly areolate. 5. *S. cristatus*

♀ involucre distinctly stipitate. 6. *S. stipitatus.*

1. SPHAEROCARPOS SPHAEROCARPOS (Dicks.) M. A. Howe, Mem. Torrey Club **7**: 66. 1899. [With the *-us* ending.]

Targionia Sphaerocarpos Dicks. Pl. Crypt. **1**: 8. 1785. — D.C. Fl. Fr. **2**: 419. 1815. — Poll. Fl. Veron. **3**: 399. 1824.

Sphaerocarpos terrestris, minima Mich. Nov. Pl. Gen. 4. *pl. 3.* 1729. — Dill. Hist. Musc. 536. *pl. 78. f. 17.* 1741.

Sphaerocarpos Michelii Bell. App. ad Fl. Pedem. 52. 1792 (*fide auctorum*); Mém. Acad. Roy. Sci. Turin **5**: 258. 1793; Usteri Ann. Bot. **15**: 87. 1795.

Sphaerocarpus terrestris J. E. Smith, Eng. Bot. *pl. 299.* 1796. — Bisch. *p. p.* Nova Acta Acad. Leop.-Car. Nat. Cur. **13**: 829–838. *pl. 44.* 1827.— Lindenb. *p. p.* Nova Acta Acad. Leop.-Car. Nat. Cur. **18**: 496. *pl. 36.* 1836.— Nees, *p. p.* Naturgesch. Europ. Leberm. **4**: 365. 1838.— Stephani, *p. p.* Bull. Herb. Boiss. **7**: 656. 1899.— Pears. *p. p.* Hep. Brit. Is. 482. *pl. 215. f. 1–14.* 1902. — K. Müller, in Rabenh. Krypt.-Fl. Deutschl. Oesterr. & Schweiz **6**: 316. *f. 190, 191.* 1907. — C. Douin, Rev. Bryol. **30**: 44–57. *f. 8–21.* 1903; **34**: 105–112. *f. 1–3, 11, 15.* 1907; **36**: 37–41. *f. 1–3, 5, 6, 8.* 1909.

Sphaerocarpus lagenarius Dumort. Comm. Bot. 78. 1822.

Sphaerocarpus utriculosus Dumort. *loc. cit.*

Sphaerocarpus terrestris, β? utriculosus Dumort. Hep. Eur. 164. 1874.

Archegonial thallus orbicular to obovate, 0.6 –13 mm. in diameter, densely cespitose, bright green when living, yellowish brown when dried, forking several times, lobes short, orbicular, margin ascending or incurved, marginal cells generally quadrate, 33–66 μ; archegonial involucres 1.5–2.5 mm. high, sessile, thickly crowded together so as almost entirely to conceal the thallus, pyriform, obovoid, or subglobose, orifice small, cells at orifice creniform, quadrate or oblong, 66–85 μ × 39–59 μ: antheridial thallus cuneate to orbicular, 1 mm. in diameter, the rounded lobes curving over the involucres, these 260–330 μ in height, purplish: capsule averaging 750 μ in diameter, the bulbous foot remaining in thallus on detachment of capsule; spores permanently united in tetrads, these 90–120 μ in diameter, greenish or brownish black, finely and regularly areolate, meshes small, 7–15 μ in diameter, each, occasionally, with a single median papilla, ridges low excepting at points of intersection, where they are raised into very acute or acicular spicules, these 7–12 μ in height. [PLATE 25.]

HABITAT: Damp sandy clay; "in clover fields" (England).

TYPE LOCALITY: Florence, Italy.

DISTRIBUTION: Italy, France, Germany, England, and Pantelleria Island (between Sicily and Tunis).

SPECIMENS EXAMINED: Five specimens from Italy, sent by Dr. E. Levier; living specimens from Ferrara, Italy, sent by Professor C. Massalongo; eight specimens from France, sent by Professor C. Douin; a specimen from Baden (between Grötzingen and Weingarten), collected by A. Kneucker; and a specimen from England, collected by W. H. Burrill, and communicated by Mr. William E. Nicholson.

Adherents of the Vienna Rules will use the name *Sphaerocarpos Michelii* for this species, while for those who follow the "American Code," its legal name is clearly that adopted above.

The areolae of the spore-tetrads of this species occasionally show an isolated median papilla or tubercle (see PLATE 25, FIGURE 12). This peculiarity is so pronounced and constant in certain collections that the possibility of its proving a diagnostic character of an unrecognized species at first suggested itself, but it soon became apparent that this character is sometimes only slightly developed (PLATE 25, FIGURE 10) and also that *S. texanus* shows a parallel series of forms (PLATE 27, FIGURES 11 and 15). It may be mentioned, however, that the spicules of some of these peculiar spore-tetrads with unipapillate areolae are less sharply pointed than is normal in *S. Sphaerocarpos*, approaching the blunt spines of certain forms (PLATE 27, FIGURES 19 and 21) which we are inclined to refer to *S. texanus*.

2. SPHAEROCARPOS TEXANUS Aust. Bull. Torrey Club **6**: 158. 1877. — Underw. Bull. Illinois State Lab. Nat. Hist. **2**: 30. 1884. — Stephani, Bull. Herb. Boiss. **7**: 656. 1899.

Sphaerocarpus terrestris Bisch. *p. p.* Nova Acta Acad. Leop.-Car. Nat. Cur. **13**: 829–838. *pl. 44.* 1827. — Lindenb. *p.p.* Nova Acta Acad. Leop.-Car. Nat. Cur. **18**: 496. *pl. 36.* 1836. — Nees, *p. p.* Naturgesch. Europ. Leberm. **4**: 365. 1838. — Pears. *p. p.* Hep. Brit. Is. 482. *pl. 215. f. 1–14.* 1902. — Stephani, *p. p.* Bull. Herb. Bois. **7**: 656. 1899.

Sphaerocarpus Berterii Aust. Hep. Bor.-Am.: Tickets of the specimens 34. 1873. Not *S. Berterii* Bisch.

Sphaerocarpus californicus Aust. Bull. Torrey Club **6**: 305. 1879. — M. A. Howe, Mem. Torrey Club **7**: 65. *pl. 100. f. 9–12.*

1899. — Stephani, Bull. Herb. Boiss. **7**: 657. 1899. — K. Müller, in Rabenh. Krypt.-Fl. Deutschl. Oesterr. & Schweiz **6**: 317. *f. 192.* 1907. — Douin, Rev. Bryol. **34**: 105–112. *f. 4–10, 12, 13, 14.* 1907; **36**: 37–41. *f. 4, 7, 10.* 1909.

Sphaerocarpus Michelii Underw. *p. p.* Bull. Illinois State Lab. Nat. Hist. **2**: 30. 1884.

Sphaerocarpus Michelii californicus (Aust.) Underw. *l. c.*

Archegonial thallus suborbicular or somewhat cuneate, 3–5 mm. × 4–8 mm., densely cespitose, bright green when living, dingy green or sometimes light olive-green when dried, forking several times, the leaf-like unistratose lobes almost entirely concealed by the overcrowding of the involucres, marginal cells generally quadrate, averaging 45 μ; archegonial involucres 1.2–2.6 mm. high, sessile, long-cylindrical, fusiform-clavate, very rarely subpyriform, more or less acuminate, cells at small orifice usually creniform, 45–60 μ: antheridial thallus oblong to orbicular, 2 mm. in diameter, forking several times, the lobes more conspicuous than those of the archegonial plant; antheridial involucres 270–360 μ high, purplish: capsule averaging 675 μ in diameter, the bulbous foot remaining in thallus on detachment of capsule; spores permanently united in tetrads, these 72–171 μ in diameter, golden-brown to dark opaque-brown, regularly areolate, minutely granulate, meshes 13–30 μ in diameter, each, in rare cases, with a single median papilla or tubercle, the ridges finally high, sinuous, crenulate, or deeply and irregularly dissected, occasionally forming obtuse spines at the points of intersection. [PLATES 26 and 27.]

HABITAT: On flat compact commonly lightly shaded soil in meadows and orchards and beside paths.

TYPE LOCALITY: San Marco, Texas.

DISTRIBUTION: United States, Uruguay, England, France, Germany, Sardinia, and Northern Africa (Tangier).

EXSICC: Hep. Bor.-Am. *no. 138*, as *S. Berterii* (in herb. New York Botanical Garden). — Hep. Brit. *no. 215*, as *S. terrestris* (in herb. Underwood). — Hep. Europ. *no. 21*, as *S. terrestris* (in herb. Underwood).

An examination of mature specimens of *Sphaerocarpos* from various parts of the United States leads to the conclusion that the plant described by Austin as *S. texanus* in 1877 cannot be satisfactorily distinguished from the plant that he described as *S. californicus* two years later. The latter name is therefore considered a synonym of the former. Austin himself seems at first to have

considered them the same, for in his Hep. Bor.-Am. (Tickets of the specimens, 34. 1873) he cites under "*138. Sphaerocarpus Berteri*" the following stations: "California, *Bolander*, *Bigelow*; Texas, *Wright*." Later he recognized his error in identifying these plants with the very different South American species and described the Texan specimens as *S. texanus* Aust. and the Californian as *S. californicus* Aust. Herr Stephani remarks (Bull. Herb. Boiss. **7**: 656. 1899) that he had not seen *S. texanus*, that it is not preserved in Austin's herbarium in Manchester, that the plant seems to be wholly lost, but that the very small spores ("coccus 63 μ") will make possible its recognition. It has been my good fortune to examine three specimens of *S. texanus* collected by Wright in Texas and now preserved in the herbaria of the New York Botanical Garden and of Columbia University. Two of these came from the Underwood herbarium, one of them being labeled "*Sphaerocarpus texanus* Aust. (type?), San Marco, Tex., C. Wright, 1849, ex coll. W. H. Pearson 1894," and the other "*Sphaerocarpus texanus*, San Marco, Texas, C. Wright, 1849, ex Sulliv." The third is in the herbarium of Columbia University, is labeled "*Sphaerocarpus texanus* Aust. Texas, leg. Wright, ex herb. Aust.," and was communicated by W. H. Pearson in 1890. Austin, in connection with the original description of *S. texanus*, compares it with "*S. Michelii*," stating the *S. texanus* is distinguished by its smaller frond, its involucre less obtuse at the apex, and the spores almost a half smaller. The coccus is described as about 1/400 of an inch (62.5 μ) in diameter, while that of *S. Michelii* is 1/200–1/250 of an inch in diameter. The present writer finds the chief differences separating *S. texanus* from *S. Sphaerocarpos* (*S. Michelii*) to lie in the more pointed fusiform-clavate rather than obovoid involucres, in the meshes of the surface of the spore-tetrads being nearly twice as wide, and in the high ridges forming these meshes being sinuous or crenulate-margined or irregularly dissected, or occasionally rising into obtuse spines at the points of intersection, but never forming sharp needle-like spines as in *S. Sphaerocarpos*. I have not been able to find in the Texan material collected by Wright any spore-tetrads as small as those described by Austin, the smallest seen measuring 72 μ. There is, however, a surprising variation in the size of the tetrads

even on a single plant: those in one capsule measured 72–99 μ, while those in another capsule on the same plant measured 92–132 μ; these two sets of spore-tetrads were about equally brown, but the smaller had smaller meshes and lower ridges and it is probable that the plant was killed before these smaller ones had reached full maturity.

As indicated above, *Sphaerocarpos texanus* seems to have a wider distribution than any other species of the genus.

It is of interest to note that the classical descriptions of *S. terrestris* given by Bischoff,* by Lindenberg,† and by Nees ‡ were based, in large part at least, on specimens collected at various times in vineyards near Durlach, Karlsruhe, Baden, by A. Braun. Now it proves that copious specimens collected by A. Braun in this locality in 1834 (the 1834 collection is mentioned by Nees) and preserved in the Mitten Herbarium are clearly *S. texanus* Aust. (see PLATE 27, FIGURE 17), and it may be said that some of the figures published by Bischoff and by Lindenberg point to *S. texanus* rather than to *S. Sphaerocarpos*. It is to be added, however, that the genuine *S. Sphaerocarpos* (*S. terrestris*)—beautifully distinct—also occurs in Baden and near Karlsruhe, as is attested by specimens collected by A. Kneucker on April 21st, 1894, in vineyards between Grötzingen and Weingarten (see PLATE 25, FIGURE 8), and it is possible that both species were represented in the material obtained by Professor Braun.

3. **Sphaerocarpos hians** sp. nov.

Archegonial thallus oblong or orbicular, 4–6 mm. in diameter, growing in isolated groups, bright green when dried, margin lobed and crispate, ascending, marginal cells generally quadrate, averaging 47 μ; archegonial involucres 1–2 mm. high, sessile, not crowded together or entirely concealing the thallus, tubular-ovoid, sometimes slightly larger at apex and slightly flaring, orifice large, of the diameter of the involucre or larger, irregular and entire, cells at orifice 26 × 39 μ, with thick walls: antheridial thallus cuneate to orbicular, 2 mm. in diameter, forking several times, the leaf-like lobes curved over the involucres, these 243–398 μ in height, green becoming brown and purplish with age, their cells,

*Nova Acta Acad. Leop.-Car. Nat. Cur. **13**: 829–838. *pl. 44.* 1827.

† *Loc. cit.* **18**: 496. *pl. 36.* 1836.

‡ Naturgesch. Europ. Leberm. **4**: 365–369. 1838.

especially those of the neck, thin-walled and nonprotuberant: capsule averaging 587 μ, the bulbous foot remaining attached to capsule; spores permanently united in tetrads, these 66–83 μ in diameter, golden-brown, cristate-reticulate, the crests sinuous, 5 μ high, delicate, somewhat elevated at the angles, occasionally crossing the boundaries of the spores, anastomosing irregularly, forming closed or partially closed meshes or occasionally running in parallel lines toward the boundaries of the spore, a blunt spine occurring now and then within the areolae, the margin in optical section appearing crenulate to tuberculate. [PLATE 28.]

HABITAT: Clayey places in copses; on bare alluvial soil in the shade of willows.

TYPE LOCALITY: Pullman, Washington.

DISTRIBUTION: Washington.

SPECIMENS EXAMINED: *C. V. Piper 91*, type, July 2, 1894, and July 21, 1894, both collected at Pullman, Washington, and preserved in the herbarium of the New York Botanical Garden.

This species resembles most closely *Sphaerocarpos cristatus*, differing markedly in the involucre being tubular with a wide or flaring orifice, instead of being subglobose with small orifice, and in the tetrads remaining permanently united, while in *S. cristatus* they separate long before maturity. The spore markings of the two species are somewhat similar, though those of *S. hians* show more regular reticulations.

4. SPHAEROCARPOS DONNELLII Aust. Bull. Torrey Club **6**: 157. 1877. — Underw. Bull. Illinois State Lab. Nat. Hist. **2**: 30. 1884. — Stephani, Bull. Herb. Boiss. **7**: 656. 1899.

Archegonial thallus cuneate, averaging 9 mm. long and 6 mm. in greatest width, forming mats, dark green, faded green when dried, forking repeatedly, lobes large, explanate, margin sinuous, marginal cells generally oblong, 33 × 66 μ; archegonial involucres 2–2.3 mm. high, sessile, not crowded together, somewhat isolated, ovoid-ellipsoid, tubular, truncate at apex, orifice somewhat conspicuous, cells at orifice 39–46 μ: antheridial thallus cuneate, 3 mm. in maximum diameter, each of its five or six main divisions once or twice furcate, lobes large, leaf-like; antheridial involucres 448–996 μ in height, 3 times their diameter, red-brown, cells with somewhat thick walls: capsule averaging 724 μ in diameter, the bulbous foot remaining in thallus on detachment of capsule; spores separating at maturity; spore-tetrad averaging 145 μ in diameter just before separating, provided with a promi-

nence 12 μ in height near the middle of the outer face of each spore, this becoming shriveled at maturity; spores 85–138 μ in maximum diameter, yellow to opaque brown and regularly areolate, coarsely granulate, meshes large, 13–26 μ, the ridges wrinkled and sinuous, forming elevations at points of intersections of meshes, the spores after separation showing a conspicuous coarsely lobed basilar margin. [PLATES 29 and 30.]

HABITAT: Growing on damp sandy soil, in gardens, etc.

TYPE LOCALITY: Jacksonville, Florida.

DISTRIBUTION: Florida and Georgia.

EXSICC: Hep. Amer. *no. 61* (as *Sphaerocarpus terrestris* Mich.) and *no. 62* (as *Sphaerocarpus Donnellii* Aust.).

5. SPHAEROCARPOS CRISTATUS M. A. Howe, Mem. Torrey Club **7**: 66. *pl. 100. f. 1–8.* 1899. — Stephani, Bull. Herb. Boiss. **7**: 657. 1899

Archegonial thallus suborbicular, 3–8 mm. in diameter, pale green when dried, marginal lobes orbicular, ascending, marginal cells generally quadrate, 26–45 μ; archegonial involucres 0.85–1.2 mm. high, sessile, thickly aggregated, at first cylindrical, soon becoming subglobose or obovoid, rounded at apex, orifice small, cells at orifice creniform, 26–40 μ: antheridial thallus cuneate, 2 mm. in diameter, often once furcate, with oblong-ovate lobes; antheridial involucres 498–581 μ in height, about 2.5 times their diameter: capsule 500–800 μ in diameter, the bulbous foot remaining attached to capsule; spores separating long before the maturity of the capsule, never persisting in tetrads, compressed, rounded-biconvex or sometimes concavo-convex, yellowish brown or pale yellow, 52–80 μ in maximum diameter, cristate, the crests sinuous, 4–7 μ high, subcrenulate, mostly radiating from near the middle of each of the two faces, often 1–3 times furcate, sparingly anastomosing, forming sometimes 1–6 (rarely more) completely closed meshes in most cases near the middle of the face. [PLATE 31.]

HABITAT: On flat compact soil in meadows and beside paths.

TYPE LOCALITY: Near Stanford University, Santa Clara County, California.

DISTRIBUTION: California.

EXSICC.: Hep. Am. *no. 160* (as *S. terrestris*, var. *californicus* Aust.) [*S texanus*], a little of which is intermingled in some of the sets in the herbarium of the New York Botanical Garden).

This remarkable species is allied to *Sphaerocarpos hians* from Washington, from which it differs in having spores that separate

early instead of remaining permanently in tetrads, in its subglobose archegonial involucre with a small orifice, instead of being long-tubular with orifice the diameter of the involucre. In both of these species the foot remains attached to the capsule on the detachment of the latter from the thallus; the spore markings are somewhat similar. In *S. Donnellii*, the spores separate at maturity, their markings are areolate instead of typically cristate, and they are characterized by a coarsely lobed basilar margin.

The description and drawings published by Professor Campbell in his "Notes on *Sphaerocarpus*" (Erythea **4**: 73–77. 1896) probably relate chiefly to this species.

6. SPHAEROCARPOS STIPITATUS Bisch.; Lindenb. Nova Acta Acad. Leop.-Car. Nat. Cur. **18**: 504 i. *pl. 36*. 1836

Sphaerocarpus Berterii Mont. Ann. Sci. Nat. II. **9**: 39. Ja 1838. — Nees, Naturgesch. Eur. Leberm. **4**: 369. 1838. — Mont. & Nees, in d'Orbigny, Voy. Am. Mérid. **7**^{2}: 50. 1839. — G. L. & N. Syn. Hep. 595. 1846. — Mont. Syll. Gen. Sp. Crypt. 95. 1846.

Sphaerocarpus Berteroi Stephani, Bull. Herb. Boiss. **7**: 657. 1899.

Archegonial thallus suborbicular to oblong, 2 mm. in diameter, in thick cushion-like tufts, light green when dried, margin divided into 4–8 cuneate, ascending, somewhat undulating lobes, marginal cells generally quadrate, averaging 26–39 μ; archegonial involucres 1.5–2 mm. high, distinctly stipitate (the slender stipes 0.5–0.65 mm. long), tubular-ovoid, ellipsoidal, or bluntly conical, more or less narrowed to the truncate apex, fleshy, carnose-opaque, its wall apparently more than one cell thick, orifice large, of nearly the diameter of the involucre, setulose, the hyaline, thick-walled setulae mostly 2 cells long, incurved: antheridial thallus not seen: capsule 340–420 μ in diameter; the persistent spore-tetrads yellowish, coarsely areolate and somewhat roughened, marginate. [PLATE 32.]

HABITAT: Growing in moist places, on the border of ditches.

TYPE LOCALITY: Quillota, Chile.

SPECIMEN EXAMINED: B. Bertero, *695*, August and September 1829, in the herbarium of the Muséum d'Histoire Naturelle of Paris, France.

The description of the capsule and spores has been derived from literature mentioned above.

NEW YORK BOTANICAL GARDEN

Explanation of plates

PLATE 25. *Sphaerocarpos Sphaerocarpos*

1. ♀ plant, mature, × 14. 2. ♀ plant, immature, × 14. 3 and 4. ♂ plants, × 29. 5. Orifice of ♀ involucre, × 48. 6, 8, 10, and 12. Spore-tetrads, × 390. 7, 9, 11, 13. Spicules and ridges of spore-tetrads shown in optical section, × 390; 7 was drawn from spore shown in fig. 6; 9, from that shown in fig. 8; 11, from that shown in fig. 10; 13, from that shown in fig. 12.

Figures 1 and 5 were drawn from a specimen collected by O. Beccari, near Florence, Italy, 9 February, 1898; 2, 3, 4, 6 and 7, from a specimen collected by E. Bacci, near Florence, Italy, 9 March, 1888; 8 and 9, from a specimen collected by A. Kneucker, between Grötzingen and Weingarten, Baden, Germany, 21 April, 1894; 10 and 11, from a specimen collected by W. H. Burrill, Strumpshaw, E. Norfolk, England, April, 1908; 12 and 13, from a specimen collected by A. Mori, at Pisa, Italy, December, 1881 (Erb. Critt. Ital., ser. II, *no. 1201*).

PLATES 26 and 27. *Sphaerocarpos texanus*

1. ♀ plant, × 14. 2. ♂ plant, × 29. 3. Orifice of ♀ involucre, × 48. 4, 5, 7, 9, 11, 13, 15, 17, 19, and 21. Spore-tetrads, × 390. 6, 8, 10, 12, 14, 16, 18, 20, and 22. Ridges of spore-tetrads shown in optical section, × 390; 6 was drawn from spore shown in fig. 5; 8, from that shown in fig. 7; 10, from that shown in fig. 9; 12, from that shown in fig. 11; 14, from that shown in fig. 13; 16, from that shown in fig. 15; 18, from that shown in fig. 17; 20, from that shown in fig. 19; 22, from that shown in fig. 21.

Figures 1, 2, 4, 9, and 10 were drawn from specimens collected by C. Wright, at San Marco, Texas, 1849; 3, 7, and 8, from specimens collected by M. A. Howe, Mill Valley, California, 4 April, 1896 (in herb. Haynes); 5 and 6, from a specimen collected by J. Arechavaleta, *no. 151*, at Montevideo, Uruguay, August, 1876 (in herb. Mitten); 11 and 12, from a specimen collected by Welwitsch, *no. 28* [Portugal?] (in herb. Mitten); 13 and 14, from a specimen collected in Tangier in the winter of 1826 (in herb. Mitten); 15 and 16, from a specimen collected by H. A. Green, Chester, South Carolina, 4 March, 1886 (in herb. Haynes); 17 and 18, from a specimen collected by A. Braun, Durlach, Baden, March, 1834 (in herb. Mitten); 19 and 20, from a specimen labeled *S. Micheli*, herb. P. V. LeRoy, Florida (in herb. New York Botanical Garden); 21 and 22, from a specimen collected by Gennari in Sardinia, April, 1889.

PLATE 28. *Sphaerocarpos hians*

1. ♀ plant × 14. 2. ♂ plant, × 29. 3. Orifice of ♀ involucre, × 48. 4, 5, and 6. Spore-tetrads, × 390. 7. Ridges of spore-tetrad shown in optical section, × 390.

The figures were all drawn from the type specimen, collected by C. V. Piper, *no. 91*, Pullman, Washington, 2 July, 1894

PLATES 29 and 30. *Sphaerocarpos Donnellii*

1. ♀ plant, × 14. 2. ♂ plant, × 29. 3. Spore, showing outer face and coarsely lobed basilar margin. 4. Spore, showing tubercular prominence on outer face, in a lateral view, × 390. 5. ♂ plant, showing greatly elongated necks of involucres on old parts of thallus, × 48. 6. Spore-tetrad, nearly mature, × 390. 7. Ridges of spore and tubercular prominence shown in optical section, × 390. 8. Spore-tetrad beginning to separate, × 390. 9. Orifice of ♀ involucre, × 48.

Figure 1 was drawn from a specimen collected by Severin Rapp, in Florida, February, 1905; 5, from Hep. Am. *no. 61*; 2, 3, 4, 5, 6, 7, 8, and 9, from Hep. Am. *no. 62*.

PLATE 31. *Sphaerocarpos cristatus*

1. ♀ plant, × 14. 2. ♂ plant, × 29. 3. Orifice of ♀ involucre, × 48. 4, 5, 6, and 7. Spores, × 390.

The figures were all drawn from the type material.

PLATE 32. *Sphaerocarpos stipitatus*

1. ♀ plant, immature, × 29. 2. ♀ involucre, × 14. 3. Orifice of ♀ involucre, showing setulae, × 120. 4 and 5. ♀ plants, × 14 (drawn to scale of other species). 6. Portion of sterile plant, × 14.

The figures were all drawn from material of the original collection preserved in the Muséum d' Histoire Naturelle of Paris.

Notes on Carex — VI

KENNETH KENT MACKENZIE

CAREX TETANICA SCHK. AND ITS ALLIES

The above species, which is widely distributed in the northeastern part of the United States, has been the source of some diversity of opinion among botanists who have given special attention to our species of *Carex*. Like many other species, it shows a considerable amount of variation, and the perigynia, moreover, seem unusually variable. Several varieties or allied species have been from time to time proposed. But all of these, with the exception of *Carex Woodii* Dewey and *Carex Meadii* Dewey, have with good reason been relegated to synonymy.

I have gone carefully over the original description of *Carex Woodii* Dewey, as well as studied some of the original specimens (almost unrecognizable scraps) collected by Dr. Wood in Jefferson County, New York, and preserved in the New York Botanical Garden. From this study it seems to me that the plant is best treated as a slim form of *Carex tetanica* Schk., and is not worthy of recognition.*

Carex Meadii Dewey, on the other hand, seems to be clearly worthy of recognition. It is undoubtedly closely related to *Carex tetanica*, but holds its distinctive features over a large area of country. The two species are, moreover, readily told apart in large collections of herbarium material, and good specimens which cannot be referred at once to the proper one of these two species are very few in number.

The curious point, however, in dealing with this group is that there are certain local plants apparently but little collected which

* Some old specimens in the Torrey Herbarium collected in Jefferson County, New York, by an unnamed collector and marked *Carex Woodii* are, however, *Carex colorata*, hereinafter described. It is possible that these represent *Carex Woodii*, but in the absence of any definite evidence I have preferred to regard the common slender form of *Carex tetanica* usually regarded as *Carex Woodii* as that plant. A good example of what I regard as *Carex Woodii* is a specimen collected June 17, 1902, by Rich, Williams & Fernald at Sudbury, Massachusetts.

are more worthy of separation than any of the plants already discussed. One of these plants from the region of the Great Lakes has long been in my collection under the name of *Carex tetanica* var. *Woodii* (Dewey) Bailey. Moreover, from the description and key it is without doubt the plant treated as *Carex tetanica* by Herr Kükenthal in the Pflanzenreich.† In that excellent work the key character used to separate *Carex livida* Wahl., and *Carex vaginata* Tausch from *Carex polymorpha* Muhl. and *Carex tetanica* Schk. (as there treated) is the following:

"Vaginae inferiores clare brunneae foliiferae"

"Vaginae inferiores purpureae aphyllae."

This key works excellently and brings out very characteristic features when applied to all the species except the real *Carex tetanica*. Any one examining it will soon see that both it and *Carex Meadii* have the lower sheaths conspicuously leaf-bearing and do not have the sheaths strongly purplish tinged. On the other hand the plant of the Great Lake region above referred to does exactly answer this description. Not only is this true but it further differs from the real *Carex tetanica* in being loosely stoloniferous. The stolons are stout for the size of the plant, are strongly purplish-tinged, and very readily pulled up. Contrasted with this, *Carex tetanica* has very deep-seated slender white running rootstocks. Any one who has ever collected the plant will know how hard and tedious an undertaking it is to get to these rootstocks. In fact it is so hard that most herbarium specimens do not show them at all. The plant of the Great Lake region is evidently worthy of recognition and is therefore here proposed as

Carex colorata sp. nov.

"*Carex tetanica* Schk." Kükenthal, in Engler, Pflanzenreich 4^{20}: 514. 1909.

Culms arising in loose stools, slender, 3–5 dm. high, aphyllopodic, strongly purplish-tinged at base, strongly stoloniferous, the stolons purplish-tinged and with loose sheaths, near the surface of the ground and readily pulled up, the culms usually noticeably

† After writing the above I was favored by Prof. Macoun with a loan of the specimens of this group from the herbarium of the Geological Survey of Canada, and found that the above statement is correct, Macoun's No. 33,639, the first specimen cited by Kükenthal under *C. tetanica*, not being that species but the species here described.

exceeding the leaves, roughened on the angles at least above, the sterile culms numerous. Leaves (not bracts) with well-developed blades usually two to four to a fertile culm, near the base but not bunched, the sheaths overlapping, rather loose, white- or yellowish-scarious opposite the blades, the ligule not prolonged, the blades flat, glabrate to minutely pubescent, the upper the larger, usually 2.5–4 mm. wide, 5–20 cm. long, strongly roughened; blades of sterile culm averaging much longer; terminal spike staminate, from but little to strongly peduncled, its peduncle smooth or little roughened, the spike linear, 1.5–3.5 cm. long, 2.5–4 mm. wide, the numerous closely appressed scales oblong-ovate, obtuse, purplish brown with green midrib and hyaline margins; pistillate spikes two or three, widely separate, erect on slender usually much exserted peduncles, the spikes linear, 1.5–3.5 cm. long, 3–4 mm. wide, loosely and alternately 6–15-flowered, the perigynia ascending; bracts leaflet-like, shorter than the culm, the sheaths 5–30 mm. long; scales obovate or ovate, obtuse or acutish, varying to acuminate or even cuspidate, wider than and about two thirds the length of mature perigynia, straw-colored or purplish brown with green midrib and hyaline margins; perigynia oblanceolate or fusiform, obtusely triangular, 3.5–4 mm. long, 1.5 mm. wide, lightly many-nerved, tapering to the base, tapering at apex into the minute slightly curving beak, 0.5 mm. long, the orifice oblique; achenes triangular, oblong, 2.5 mm. long, closely fitting the perigynia; stigmas three.

The type of the above species was collected by Mr. Charles K. Dodge at Port Huron, Michigan, on May 9, 1896, and is in my herbarium. A duplicate has been deposited in the herbarium of the New York Botanical Garden.

Other specimens of this species, all in the herbarium of the Geological Survey of Canada, except where otherwise stated, have been examined as follows:

ONTARIO: Guelph, *Klugh*, June 8, 1905 (K. K. M.); Sarnia, *Macoun 33639*, June 11, 1901 (referred by Kükenthal to *C. tetanica*); Wyoming, *Macoun 33740*, June 14, 1901; Galt, *Herriot 63112*, June 13, 1902; Belleville, *Macoun 31974*, June 15, 1862 (in part).

MICHIGAN: Michigan Agricultural College, *C. F. Wheeler*, June 5, 1900.

MANITOBA: Brandon, *Macoun 16662*, June, 1880; Grand Valley, Brandon, *Macoun 77117*, June 16, 1880.

NEW YORK: Jefferson Co. (Columbia Univ.).

The second plant referred to which seems worthy of separation is a plant of the mountains of North Carolina, distributed in considerable quantities in recent years by the Biltmore collectors. Like *Carex colorata* this species differs from *Carex tetanica* and *Carex Woodii* in not having the lower sheaths blade-bearing and in being strongly purplish-tinged at base. It, however, lacks the strong stolons so characteristic of *C. colorata*, but has stout, much interwoven and elongated rootstocks, like those of *Carex polymorpha*. In addition, it is a stout plant with broader leaf-blades. In fact it seems to be a local type characteristic of some of the higher country of North Carolina, and in honor of the institution which has distributed most of the specimens seen by me it is here proposed as

Carex biltmoreana sp. nov.

Culms arising in close stools from stout elongated and interwoven rootstocks, erect, stout (3–4 mm. wide towards the base), 3–7 dm. high, aphyllopodic, strongly purplish-tinged and somewhat fibrillose at base, not strongly stoloniferous, exceeding the leaves, smooth or more or less roughened on the angles above. Leaves (not bracts) with well-developed blades usually three to five to a fertile culm, near the base but usually not bunched, the sheaths overlapping, loose, glabrate, white- or yellowish-scarious opposite the blades, the ligule often strongly prolonged, the blades flat, 3.5–5 mm. wide, usually 1–2 dm. long, very rough towards apex, the lower much smaller than the upper; terminal spike staminate, strongly rough-peduncled, linear, 2–3 cm. long, 4–5 mm. wide, the numerous closely appressed scales oblong-obovate, obtuse, purplish brown with light midrib and hyaline margins; pistillate spikes one to three, widely separate or uppermost occasionally approximate, erect, on slender usually much exserted peduncles, the spikes linear or linear-oblong, 1.5–3.5 cm. long, 4–8 mm. wide, loosely or somewhat closely flowered above, attenuate at base, the perigynia 6–20, ascending; bracts leaflet-like, shorter than the culm, the sheaths 5–30 mm. long; scales ovate, varying from obtuse to cuspidate, as wide as but rather shorter than the mature perigynia, straw-colored or purplish brown with green midrib and hyaline margins; perigynia obovoid, obtusely triangular, 2.5–3.5 mm. long, 1.5–2.25 mm. wide, many-nerved, tapering to a stipitate or substipitate base, abruptly rounded at apex and minutely beaked with abruptly bent beak or beakless, the orifice entire; achenes triangular with convex sides, broadly obovoid, 2.5 mm. long, closely fitting the perigynia; stigmas three.

The following specimens have been examined:

NORTH CAROLINA: Satula Mt. (near Highlands), Biltmore *no. 2686*, May 25, 1897 (type in herb. N. Y. Bot. Gard.); Macon County, *Buckley* (Columbia Univ.); Chimney Rock Mt., Rutherford County, Biltmore *no. 268e*, May 10, 1898 (N. Y. Bot. Gard.); Craggy Mt., Buncombe County, Biltmore *no. 268a*, May 18, 1898 (N. Y. Bot. Gard.).

The species discussed under this heading may be distinguished from one another by the following key:

Culms phyllopodic, not strongly purplish-tinged at base, spreading by deep-seated slender white rootstocks.
- Blades of fertile culm 2–3.5 mm. wide; perigynia 2–3 mm. long; spikes linear; plant slender. *C. tetanica.*
- Blades of fertile culm 3–7 mm. wide; perigynia longer; spikes oblong or linear-oblong; plant stoutish. *C. Meadii.*

Culms aphyllopodic, strongly purplish-tinged at base, loosely stoloniferous or with interwoven stout rootstocks.
- Loosely stoloniferous; culms slender; larger blades 4 mm. wide. *C. colorata.*
- Not loosely stoloniferous, but with interwoven stout rootstocks; culms stout; larger blades 5 mm. wide. *C. biltmoreana.*

CAREX RIPARIA AND ITS NORTH AMERICAN ALLIES

The common sedge which has of late years been treated in our text-books as specifically identical with *Carex riparia* Curtis of Europe was by many of our earlier writers treated as a distinct species under the name of *Carex lacustris* Willd. In the treatment of the genus *Carex* in the Pflanzenreich, Herr Kükenthal has adopted a middle course and made our plant a variety of the European plant. He has, however, clearly pointed out the marked differences which exist between the two. These differences hold good in a large series of American specimens and a considerable series of European specimens examined by me. The plants, too, do not have a circumboreal distribution, and, as is well known, there are very few American species of *Carex* not having a circumboreal distribution which are specifically identical with European species. There being these marked differences between the European and American plants and their ranges being so different I cannot understand how one can logically be treated as a variety of the other. It seems to me that the only proper way to do is to recognize the plants as distinct species, and this is what I shall do.

Briefly stated, the European *Carex riparia* is a plant with closely bunched and very thick staminate spikes, the pistillate scales are large and very conspicuously purplish-margined, the fertile culms are phyllopodic, and the lower sheaths are neither fibrillose nor strongly purplish-tinged. On the other hand, the American *Carex lacustris* has scattered slender staminate spikes, the pistillate scales are smaller and the purplish margins generally noticeably less conspicuous, the fertile culms are aphyllopodic, and the lower sheaths are strongly fibrillose and strongly purplish-tinged.

Carex lacustris, as above defined, has a range from Maine and Vermont to Delaware, Minnesota, and Iowa. In the South and West, however, its place is taken by an allied but distinct plant of wide distribution. Although this last-mentioned plant has not in general been differentiated from *Carex lacustris*, yet many years ago it was published by S. Hart Wright as a variety of *Carex riparia* under the name *Carex riparia* var. *impressa* (Bull. Torrey Club **9**: 151. 1882). It has the scattered slender staminate spikes of *Carex lacustris* and its pistillate scales are even lighter-colored and with less of a purplish tinge. On the other hand it has the phyllopodic fertile culms not tinged with purplish or but little so and not fibrillose at the base, which are characters of the European *Carex riparia*. From both these species it differs also in the perigynia, which are impressed-nerved when young, but at maturity appear nerveless at a distance or on close inspection very finely impressed-nerved, in contradistinction to the strongly nerved perigynia of the other species above discussed. This plant doubtless deserves specific rank, as the following detailed description will show:

Carex impressa (S. H. Wright) Mackenzie, comb. nov.

Carex riparia impressa S. H. Wright, Bull. Torrey Club **9**: 151. 1882.

Culms stout, in dense clumps, 5–8 dm. high, phyllopodic, neither fibrillose nor purplish-tinged at base, stoloniferous, exceeded by the leaves, smooth or more or less roughened on the angles above. Leaves with well-developed blades usually six to twelve to a fertile culm, mostly bunched towards the base, the blades 4–7 mm. wide, sometimes as much as 4 dm. long, flattened or folded at base, nodulose, stiff, varying from smooth on both

surfaces and on the margins (towards the base) to strongly roughened on both surfaces and to almost denticulate on the margins (towards the apex), more or less glaucous, the sheaths glabrous; terminal 2–4 spikes staminate, erect, scattered, 1–4 cm. long, 3–7 mm. wide, the upper peduncled, the others sessile or nearly so, the numerous closely appressed scales oblong-obovate, acute to aristate, from straw-colored to purplish, with hyaline margins and usually lighter midrib; pistillate spikes two to four, usually widely separated, erect, short-peduncled, stout, densely flowered, oblong-cylindric, 1–7.5 cm. long, 1 cm. wide, the very numerous perigynia closely appressed, ascending, in several–many ranks; bracts leaf-like, exceeding the culms, the lower sheaths from little to strongly developed; scales ovate, the lower aristate and often exceeding the perigynia, the others gradually shorter until those in the upper part are acute and but half the length of the perigynia, straw-colored to purplish with hyaline margins and lighter center, very variable; perigynia lanceolate-ovoid, flattened but thick, 6 mm. long, 2.5 mm. wide, impressed-nerved but appearing nearly nerveless at maturity, glabrous, the walls thick and leathery, rounded at base, tapering to the short bidentate beak, the teeth erect or slightly spreading, 0.5 mm. long; achenes triangular-obovoid, 2 mm. long, 1.25 mm. wide, not filling perigynia, tipped by the persistent slightly flexuous style; stigmas three.

The following specimens have been seen:

OHIO: Green Spring, *Beardslee*, June, 1890.

INDIANA: Wells County, *Deam;* Bluffton, *Deam*, May 28, 1899.

TENNESSEE: Jackson, *S. M. Bain 488*, May 10, 1893.

MISSOURI: Courtney, Jackson County, *Bush 702*, May 23, 1894; Jackson Co., *Mackenzie 822*, April 27, 1895; Butler County, *Bush 2554* and *2660*, May 1, 1905.

KANSAS: Quindaro, *Mackenzie*, May 30, 1897; Argentine, *Mackenzie*, April 26, 1896.

INDIAN TERRITORY: Catoosa, *Bush 1028*, May 14, 1895; Sapulpa, *Bush 957*, May 9, 1895; Arkansas, *Bush 985*, May 8, 1895.

ARKANSAS: Moark, *Bush 2609*, May 3, 1905; Miller Co., *Bush 1394*, April 21, 1902; Craighead Co., *Eggert*, May 7, 1893.

TEXAS: Grand Saline, *Reverchon 2441*, April 9, 1901; Dallas, *Reverchon 3311**, April, May; Alvin, *S. M. Tracy 9008*, April 11, 1906.

LOUISIANA: Alexandria, *Hale*.

ALABAMA: Mobile, *C. F. Baker 1555*, April 26, 1898.

GEORGIA: Riceboro, Liberty Co., *Harper 2183*, May 2, 1904. FLORIDA: Apalachicola, *Chapman, Biltmore no. 225a*; *Chapman*, 1850.

The three species here described may be separated by the following key:

Fertile culms aphyllopodic, strongly fibrillose and purplish-tinged at base. *C. lacustris.*
Fertile culms phyllopodic, neither fibrillose nor strongly purplish tinged at base; perigynia nerved.
Staminate spikes slender, scattered; perigynia finely impressed-nerved or appearing nearly nerveless at maturity; pistillate scales not prominently purplish-margined. *C. impressa.*
Staminate spikes thick, closely approximate; perigynia strongly nerved at maturity; pistillate scales prominently purplish-margined. *C. riparia.*

NEW EASTERN SPECIES OF CAREX

Carex aestivaliformis sp. nov.

Carex gracillima × *aestivalis* Bailey, Bull. Torrey Club **20**: 417. 1893.

Culms densely cespitose, slender, erect or ascending, 3.5–7 dm. high, glabrous or nearly so, sharply triangular and roughened on the angles above, exceeding the leaves, strongly purplish-tinged at base, aphyllopodic. Well-developed blades some four or five to a fertile culm, the sheaths (especially the lower) sparsely short-pubescent, the upper not overlapping; blades glabrous or sparsely pubescent and ciliate near base, rough, 2–3.5 mm. wide, the longer about 3 dm. long, flat, ascending; spikes three or four, widely separate or slightly approximate, narrowly linear, 1.5–6 cm. long, 3.5 mm. wide, the terminal gynaecandrous, the lateral pistillate, nodding or weakly erect on long, slender, rough peduncles, the perigynia 20–40, appressed-ascending, closely packed in few ranks or loosely at base; lowest bract leaflet-like, short-sheathing, shorter or longer than inflorescence, the upper reduced; scales ovate, short-acuminate, acute or obtuse, several-nerved, green with hyaline margins, sometimes tinged with reddish brown, narrower than and about two thirds the length of the perigynia; perigynia oblong-ovoid, flattened-triangular in cross-section, deep green, glabrous, strongly several-nerved, 3–3.5 mm. long, 1.5 mm. wide, sessile and rounded at base, abruptly very short beaked, the beak 0.25 mm. long, minutely bidentate and hyaline-tipped; achenes triangular-obovoid, 2 mm. long, 0.75 mm. wide, not filling perigynia; style straight, slender; stigmas three.

The species above described has to my knowledge been collected in six localities, and each time the collector has had trouble

with it. The first collection was in an upland swale near Alcove, New York, on July 5, 1892, by C. L. Shear, and it was later found by him in two other localities in Greene County, New York. His collections were first doubtfully referred to *Carex Sullivantii* Boott, and later on were described by Professor Bailey (Bull. Torrey Club **20**: 419. 1893) as a hybrid between *Carex gracillima* and *Carex aestivalis*. He, however, pointed out that there were two objections to so classifying the plant, the first being that it had characters possessed by neither of its supposed parents, and the second that *Carex aestivalis* was not known from the country where the present plant was found. Specimens now at hand from the other stations emphasize these two points, and show that the plant cannot be properly treated as it was by Professor Bailey.

The next collection was by me in a mountain meadow near Greenwood Lake, Passaic County, New Jersey, on June 23, 1907 (*no. 2676*). The plant was not common, but as I collected enough to make several specimens, I designate a specimen from this collection as the type of the species.

The plant has lately again been found in eastern Pennsylvania by Mr. S. S. Van Pelt (Wissahickon ravine, Philadelphia Co., east side, above Thorp's Lane, high up, July 17, 1909). Through him it was sent to the New York Botanical Garden with a request that he be informed whether it was *Carex aestivalis* or not.

As a matter of fact the plant is closest to *Carex aestivalis*, but is distinguished by the larger perigynium, which has a bidentate beak, that of *C. aestivalis* not being bidentate. From *Carex Sullivantii*, supposed to be a hybrid between *Carex pubescens* and *C. gracillima*, it is distinguished by the gynaecandrous terminal spike, merely acute or short-acuminate scales, and somewhat narrower and less pubescent leaves. I do not know any hybrid it can represent, and, as it is certainly distinct enough, I here propose it as a species.

The southern *Carex oxylepis*, which is closely allied, has wider and generally more pubescent leaves and strongly acuminate or cuspidate scales.

Carex fulvescens sp. nov.

Culms loosely cespitose from slender rather short rootstocks, erect, 2.5–4 dm. high, rather sharply triangular, smooth or slightly

roughened on the angles above, exceeding the leaves, phyllopodic, and slightly fibrillose at base. Well-developed blades about six to ten to a fertile culm, flat or somewhat folded at base, 2–3 mm. wide, 1.5 dm. long or less, erect or ascending, roughened towards the apex, the sheaths of the upper and of the bracts prolonged at the mouth and strongly tinged with chestnut-brown; staminate spike solitary, slender-peduncled, 1.5–2.5 cm. long, 2–3 mm. wide, the oblong-obovate scales closely appressed, obtuse or subacute, chestnut with white-hyaline margins and apex; pistillate spikes one or two, widely separate, erect, the upper on scarcely exserted peduncle, the lower on a strongly exserted peduncle, short-oblong or oblong, 12–20 mm. long, 7.5–10 mm. wide, closely flowered, the perigynia 15–35, spreading-ascending in several ranks; bracts strongly sheathing, the blades erect, much shorter than inflorescence; scales ovate, short, acute or obtuse, brownish chestnut with conspicuous white-hyaline apex and margins above, the center lighter-tinged, nearly as wide and nearly as long as body of perigynia; perigynia yellowish-green, narrowly elliptic, slightly inflated and suborbicular or obscurely triangular in cross-section, 5–6 mm. long, 1.5–2 mm. wide, strongly and rather closely about 10-nerved, rounded to a substipitate base, and contracted into a rough strongly bidentate beak 1.5 mm. long, the erect slender teeth smooth within; achenes triangular, oblong-obovoid, 2 mm. long, 1 mm. wide, long-tapering at base; style slender; stigmas three.

Many years ago B. D. Greene collected near Boston two species of *Carex*, which are now in the Torrey Herbarium. One of these was described by Dewey in 1836 as *Carex Greeniana* (Am. Journ. Sci. **30**: 61). This name has by most subsequent authors been treated as a synonym of *Carex Hornschuchiana* Hoppe ("*Carex fulva* Good." of most authors). An examination of both the original specimen and the original description of Dewey shows that this course is erroneous. The specimen marked *Carex Greeniana* is a specimen of the European *Carex helodes* Link (*Carex laevigata* Smith) and has the long-acuminate or aristate scales of that species, in this agreeing with Dewey's description, which calls for a plant with cuspidate or mucronate scales.

The other specimen, which is marked "*Carex fulva* Good." is closely related to the European *C. Hornschuchiana* Hoppe and furnishes one of the chief reasons for attributing that species to North America, as has been done for years under the name of "*Carex fulva* Good." What *Carex fulva* Good. really is, has,

however, long been a favorite theme for discussion among European students of *Carex* (Pryor in Jour. Bot. **14**: 366; Kükenthal in Allgem. Bot. Zeits. **11**: 45), and while the older authors generally treat it and *Carex Hornschuchiana* as the same, later authors regard *C. fulva* as representiug something else and have taken up the name *Carex Hornschuchiana* for what was formerly called *C. fulva*.

While closely resembling this European species, the Boston plant differs in the longer perigynia (5–6 mm. long), as compared to perigynia of about 3 mm. in length in the European species. (Kükenthal, Pflanzenreich 4^{20}: 665, and numerous specimens examined by me.) In addition, the usually more obtuse scales are very noticeably more white-hyaline at the apex, the spikes are wider and heavier, and the sheath is generally more strongly prolonged opposite the blade and more strongly tinged with dark chestnut.

Besides the specimen collected near Boston (possibly introduced through wild fowls from further north), I have seen specimens from Anticosti (Ellis Bay, *John Macoun 50*, Sept. 7, 1883) and Miquelon (Valley of La Belle-Rivière, *Louis Arsene 93*, July 28, 1902). It is probable, too, that the reports of the occurrence of *Carex fulva* in Newfoundland arise from finding this species there.

Carex Bushii sp. nov.

Carex hirsuta, var. *cuspidata* Dewey, Wood's Class Book 758. 1863.

Carex triceps, var. *longicuspis* Kükenthal, Pflanzenreich 4^{20}: 431. 1909.

Culms erect, 3–6 dm. high, growing in medium-sized clumps, glabrate or somewhat pubescent, triangular, shorter than or exceeding the leaves, somewhat purplish-tinged at base. Well-developed blades three or four to a fertile culm, the sheaths short-pubescent, the upper not overlapping, blades short-pubescent (especially below), 1.5–3 mm. wide, the larger 2.5 dm. long, flat, erect-ascending, the uppermost leaf usually inserted shortly below and exceeding the spikes; spikes usually two or three, approximate, oblong or oblong-cylindric, 5–20 mm. long, 5–8 mm. wide (without the scales), the lower half of the uppermost staminate, the remainder pistillate, all erect, sessile or nearly so, densely many-flowered; bract of lowest spike slender, setaceous, some-

what to much exceeding the head; second bract when present much smaller; scales of pistillate flowers triangular-lanceolate, the middle and lower strongly rough-cuspidate, narrower than but exceeding the perigynia (usually strongly so), with green, about 3-nerved center and hyaline often brownish-tinged margins; perigynia obpyramidiform, nearly orbicular in cross-section, swollen and squarrose at maturity, tapering at base, somewhat tapering at the blunt or slightly pointed apex, glabrous, green or becoming brownish at maturity, rather strongly and coarsely ribbed, 2.5–3 mm. long, 1.5–2 mm. wide, the orifice entire or minutely emarginate; achenes strongly triangular, obovoid, large, sometimes 2.5 mm. long and 1.8 mm. wide; style persistent, bent; stigmas three.

The above species is based primarily on Mr. B. F. Bush's *no. 2514*, collected April 30, 1905, at Fulton, Arkansas, and preserved in my own herbarium, but it seems common enough, and from the descriptions there can be no doubt that the synonyms quoted above belong here. I first became acquainted with this plant in 1896 when botanizing on the prairie at Waldo Park, immediately south of Kansas City, Missouri, in company with Mr. Bush, and since then have gradually been accumulating a series of specimens. I am glad indeed to be able to associate Mr. Bush's name with the present plant, and as he seems to have collected more material of it than any other botanist it seems peculiarly appropriate to do so.

Study in recent years has shown that *Carex hirsuta* Willd. of the earlier botanists is undoubtedly an aggregate, and all modern students of the group have treated it either as containing more than one species, or as one species with several strongly marked varieties. The former course seems to me much the more scientific and is accordingly adopted here. The division here made of the old *Carex hirsuta* has been primarily based on the shape of the perigynium. In the plant of Willdenow this is much flattened, ascending, rounded at apex, and more nerved than ribbed. In the other group it is inflated, squarrose, suborbicular in cross-section, pointed at the apex, and strongly ribbed at least towards the apex. The first group is represented by *Carex hirsuta* Willd. and *Carex triceps* Michx., the former differing from the latter only in the more developed pubescence of the leaves, a character which a large series of specimens shows is of no value.

The second group is represented by *Carex caroliniana* Schwein. as well as by *Carex Bushii* here described. The large green

perigynia and strongly rough-cuspidate scales of the latter contrast strongly with the smaller brownish green perigynia and short scales of the former. For convenience these species may be keyed as follows:

Perigynia much flattened, ascending, rounded at apex, nerved.	*C. hirsuta.*
Perigynia swollen, nearly orbicular in cross-section, squarrose, tapering at apex, coarsely ribbed.	
Perigynia 2 mm. long, brownish green; scales not rough-cuspidate.	*C. caroliniana.*
Perigynia longer, green; scales rough-cuspidate.	*C. Bushii.*

Carex Bushii ranges from Rhode Island (*fide* Kükenthal) and New York to Kansas and Texas and eastward along the coast to northwestern Florida. I have seen the following specimens:

RHODE ISLAND: *Olney* (mixed).*

NEW YORK: Oneida Co., *Haberer 1125*, June 20, 1902; Washington County, *Burnham 48*, July 8, 1898 ("Grows with the species, but at once recognized as different"); Penn Yan, *Sartwell.*

PENNSYLVANIA: Lancaster County, *Carter*, June, 1893 ("very large; var.") and July 11, 1909; Nockamixon Rocks, Bucks County, *Britton*, May 30, 1893; West Chester, *Townsend;* Rockhill, Bucks County, *MacElwee 382*, June 2, 1899.

ILLINOIS: "Illinois" *Vasey* — "*Carex triceps* v. *cuspidata* Dewey"; Jefferson County, *Eggert*, May 16, 1898.

MISSOURI: St. Louis, *Riehl*, 1838; Montier, *Bush 691*, May 15, 1894; *2800*, May 11, 1905; *2896*, May 17, 1905; and *4670*, May 24, 1907; Desoto, *Hasse*, May 24 1887; Courtney, *Bush 1719*, May 26, 1902; Waldo Park, Jackson Co., *Mackenzie*, June 10, 1896.

ARKANSAS: Little Rock, *Hasse*, May, 1885; Fulton, *Bush 2514*, April 30, 1905 (type, in herb. K. K. Mackenzie).

INDIAN TERRITORY: Sapulpa, *Bush 1047*, May 2, 1895.

KANSAS: Cherokee County, *Hitchcock 871*, 1896.

TEXAS: Lindale, *Bush 2449*, April 23, 1901; Alvin, *Tracy 9009*, April 11, 1906; Raleigh, *Reverchon 3619*, April 16, 1903; Galveston, *Plank*, April 10, 1892.

LOUISIANA: New Orleans, *Hooker*, 1827.

* The Olney distribution of *Carex* seems unfortunately to have become mixed, and it is not safe to rely on the specimens distributed by him in determining the range of any species.

MISSISSIPPI: Starkville, *Tracy 1375*, April 14, 1890.
FLORIDA: Walton County, *Curtiss*, 1885.

NOTES ON NOMENCLATURE

In applying the rules of nomenclature of the "American Code" to the species of *Carex* found in North America, it has been found that a considerable number of species have been known by names which are not tenable. For some of these species valid names exist but to others new names must be given, and for various reasons certain other necessary changes in names must also be made, as follows:

Carex hirtifolia nom. nov.

Carex pubescens Muhl.; Willd. Sp. Pl. **4**: 281. 1805. Not *C. pubescens* Poir. Voy. en Barb. **2**: 254. 1789. Not *C. pubescens* Gilib. Exerc. Phyt. **2**: 547. 1792.

Carex camporum nom. nov.

Carex marcida Boott; Hook. Fl. Bor.-Am. **2**: 212. *pl. 213*. 1840. Not *C. marcida* J. F. Gmel. 1791.

Carex normalis nom. nov.

Carex mirabilis Dewey, Am. Journ. Sci. **30**: 63. *pl. Bb. f. 92*. 1836. Not *C. mirabilis* Host. 1809.

Carex glacialis nom. nov.

Carex pedata Wahl. Fl. Lapp. 239. *pl. 14*. 1812. Not *C. pedata* L. 1763.

Carex Farwellii (Britton) Mackenzie, comb. nov.

Carex deflexa Farwellii Britton; Britton & Br. Ill. Fl. **1**: 334. 1896.

Carex abscondita nom. nov.

Carex ptychocarpa Steud. Synops. Cyper. 234. 1855. Not *C. ptychocarpa* Link. 1799.

Carex debiliformis nom. nov.

Carex cinnamomea Olney, Proc. Am. Acad. **7**: 396. 1868. Not *C. cinnamomea* Boott. 1846.

CAREX LASIOCARPA Ehrh. Hann. Mag. **9**: 132. 1784.

"*Carex filiformis* L." Good. Trans. Linn. Soc. **2**: 172, and of all American authors; not *Carex filiformis* L.

European writers have determined that the name *Carex filiformis* L. is not applicable to the plant which has so generally borne the name, but is properly applicable to *Carex tomentosa* L. Accordingly they now apply the name *Carex lasiocarpa* Ehrh. to the plant heretofore known as *Carex filiformis* L.— a course which is here followed. The description and locality of the plant of Linnaeus do not apply to the plant treated by authors as *Carex filiformis*, although there is a specimen of this plant in the Linnæan herbarium so named. See on this point Kükenthal, Pflanzenreich 4^{20}: 748.

CAREX LEERSII Willd. Prodr. Fl. Berol. 28. 1787

Carex stellulata Good. Trans. Linn. Soc. **2**: 144. 1794.
Carex sterilis Willd. Sp. Pl. **4**: 208 (in greater part). 1805.

CAREX SPRENGELII Dew.; Spreng. Syst. **3**: 827. 1826

Carex longirostris Torr.; Schwein. Ann. Lyc. N. Y. **1**: 71. 1824. Not *C. longirostris* Krock. 1814.

CAREX BARRATTII Schw. & Torr. Ann. Lyc. N. Y. **1**: 361. 1825

Carex littoralis Schwein. Ann. Lyc. N. Y. 1: 70. 1824. Not *C. littoralis* Krock. 1814.

Carex Howei nom. nov.

Carex interior, var. *capillacea* Bailey, Bull. Torrey Club **20**: 426. 1893.
Carex delicatula Bicknell, Bull. Torrey Club **35**: 495. 3 N 1908. Not *C. delicatula* C. B. Clarke, Kew Bull. Misc. Inf. Add. Ser. 8: 79. 18 Au 1908.

Named in honor of the late Dr. E. C. Howe, a careful student of the difficult group to which this species belongs.

CAREX ATHERODES Spreng. Syst. **3**: 828. 1826

Carex aristata R. Br. in Frankl. Narr. Journ. Bot. App. 36. 1823. Not *C. aristata* Honck. 1792. Not *C. aristata* Clairv. 1811.

Carex rhomalea (Fernald) Mackenzie, comb. nov.

Carex saxatilis, var. *rhomalea* Fernald, Rhodora **3**: 50. 1901.

CAREX LACHENALII Schk. Riedgr. 51. *pl. y. f. 79.* 1801.

Carex lagopina Wahl. Kongl. Vet.-Acad. Handl. **24**: 145. 1803.

Carex mesochorea nom. nov.

Carex mediterranea Mackenzie, Bull. Torrey Club **33**: 441. 1906.
Not *C. mediterranea* C. B. Clarke. 1896.

Carex aggregata nom. nov.

Carex agglomerata Mackenzie, Bull. Torrey Club **33**: 442. 1906.
Not *C. agglomerata* C. B. Clarke. 1903.

Carex amphigena (Fernald) Mackenzie, comb. nov.

Carex glareosa, var. *amphigena* Fernald, Rhodora **8**: 47. 1906.

CAREX ANNECTENS Bicknell, Bull. Torrey Club **35**: 492. 1908.

Carex xanthocarpa Bicknell, Bull. Torrey Club **23**: 22. 1896.
Not *C. xanthocarpa* Degl. 1807.

Carex xanthocarpa annectens Bicknell, Bull. Torrey Club **23**: 22. 1896.

Carex Swanii (Fernald) Mackenzie, comb. nov.

Carex virescens, var. *minima* Barratt; Bailey, Mem. Torrey Club **1**: 77. 1889. Not *Carex minima* Boullu. 1878).

Carex virescens, var. *Swanii* Fernald, Rhodora **8**: 183. 1906.

"*Carex virescens* Muhl." Britton & Br. Ill. Fl. **1**: 316. *f. 743.* 1896, and of other recent writers.

Common in the northeastern part of the United States are two closely related sedges, one or the other of which has been treated as *Carex virescens* Muhl. by authors who have had occasion to deal with them. Unfortunately, there has been considerable diversity of opinion as to which plant should bear the name, and the facts on which the question must be decided seem somewhat contradictory. So much is this so that Professor Fernald (Rhodora **8**: 182, 183) and Mr. Bicknell (Bull. Torrey Club **35**: 488, 489) have reached opposite conclusions.

Before taking up the literature on the subject, it is necessary to obtain a clear idea of the two species, and this is all the more requisite because there are certain distinctions between them, not always emphasized, which help materially to clear up the difficulty.

The first of the species referred to is a tall slender plant strongly reddened at base, generally 4–7 dm. high with the culms much exceeding the leaves. The uppermost stem leaf is usually inserted 2–3 dm. below the spikes, but occasionally at a less distance. The lowest bract is leaflet-like, 0.5–2 mm. wide, and somewhat exceeding the spikes. The spikes themselves are two to four in number, linear-cylindric, 12–35 mm. long, and 2.5–4 mm. wide. The perigynia are oblong-elliptic, round-tapering at apex, and generally strongly costate. This last character is, however, variable and the ribs at times are even less prominent than in the other plant. The perigynia too, especially towards the base of the terminal spike, are apt to become broadly obovoid and rounded at apex.

The second plant is also slender but much lower (2–5 dm. high). The reddening at base is rarely much developed, and the culms are exceeded by the leaves. The uppermost stem-leaf is usually inserted 3 cm. below the spikes, but occasionally as much as 12 cm. The lowest bract is very narrow (0.5 mm. wide) and about twice exceeds the uppermost spike. The spikes are oblong-cylindric, 5–20 mm. long and 3–5 mm. wide. The perigynia are broadly obovoid, rounded at apex and from little to markedly costate.

These two plants are perfectly distinct and I have been able to discover little warrant for the statement that there are "numerous transitional specimens." Undeveloped specimens are at times hard to place but this is true in all groups of critical species.

Following Professor Bailey, the second plant above described has of late years been treated as *Carex virescens*. His treatment was based on the fact that in studying the types of *Carex* in European herbaria he had occasion to look up the plant under discussion in the Willdenow herbarium. He says of the specimen found there: "a slender and short-spiked form. *C. triceps* var. *hirsuta* Bailey is also on the same sheet, but the description applies to *C. virescens*" (Mem. Torrey Club 1: 60, also 76, 77, and 78). In

other words, there has evidently been some confusion of specimens in this case as in others, and one is not justified in accepting the sheet in the Willdenow herbarium as containing the type of *Carex virescens* unless the specimen there accords with the description.

Turning to the description it will certainly be admitted that a short-spiked form does not answer to a description which calls as in the present case for a linear spike, and, this being so, our only safe course is to study the original description and ignore the plant in the Willdenow herbarium.

Like a number of other Carices described by Muhlenberg, *Carex virescens* was published first in Willdenow's Species Plantarum (**4**: 251) in 1805, and secondly in Schkuhr's Riedgraser Nachtr. (45) in 1806. The descriptions are practically identical, but the second is accompanied by a plate (*Mmm. f. 147*). The description reads:

"C. spica androgyna lineari pedunculata inferne mascula, femineis subapproximatis binis subpedunculatis linearibus, fructibus globoso-triquetris obtusis pubescentibus. . . . Capsula[e] maturae virides subnervosae pubescentes."

The plate shows a young plant with the uppermost stem-leaf inserted much below the spikes and a broad (comparatively) lower bract somewhat exceeding the spikes. A more mature specimen is also shown with the same kind of lower bract and *strongly costate* perigynia round-tapering at apex. The spikes in both cases are shown to be linear-cylindric. Both these figures seem to me to represent the larger of the two plants under discussion. There are also figured separately obovoid perigynia without ribs on one-half but ribbed on the other half. The draftsman apparently here attempted to give a side view so as to show the nerveless inner surface of the perigynia and the nerved outer surface at the same time. The result is an uncharacteristic drawing, but there is nothing about it inconsistent with the same reference as the rest of the plate.

The plate and the description calling for a linear spike both answer then to our larger plant, and I feel justified in following Professor Fernald in so treating it. I do not, however, think that the identity of the smaller plant should be obscured by treating it as a variety. Accordingly, I have here used Professor Fernald's

varietal name as a specific one, the earlier varietal name of Barratt having already been used for a species.

CAREX RECTA Boott, Hook. Fl. Bor.-Am. **2**: 220. *pl. 222.* 1840

Carex salina, var. *kattegatensis* (Fries) Almq. in Hartm. Handb. Scand. Fl. 466. 1879. [ed. 11.]

" *Carex cuspidata* Wahl." Britton & Br. Ill. Fl. **1**: 311. 1896.

" *Carex salina*, var. *cuspidata* Wahl." Gray's Manual 230. 1908. [ed. 7.]

In dealing with the various closely allied plants which by some authors have been treated as species and by others as varieties of *Carex salina* Wahl., the latest author to study the group (Kükenthal, Pflanzenreich 4^{20}: 361–363) has pointed out that the name *Carex cuspidata* Wahl. is not applicable to the plant found on the northeastern coast of this continent. The name to be taken up for this plant is *Carex recta* Boott, or if one prefers a varietal name the pleasant-sounding name given in the synonymy above is open to him.

In this connection it may be pointed out that *Carex lanceata* Dewey (Am. Journ. Sci. **29**: 249), referred by Kükenthal, following Boott, to *Carex salina* as a variety, is probably a mixture of *Carex livida* (Wahl.) Willd. and *Carex salina* Wahl. The original collection in the Torrey herbarium is mixed and contains both species, and the description applies in part to both species, while Dewey compares the species to his *Carex Grayana* (a synonym of *Carex livida*). The plate (a poor one) is of *Carex salina*, but it does not agree with the description.

CAREX ATLANTICA Bailey, Bull. Torrey Club **20**: 425. 1893

In Professor Fernald's very able paper on the Northeastern Carices of the Section Hyparrhenae (Proc. Am. Acad. **38**: 447 *et seq.*) there is very little to which one can take exception, but on the contrary a careful study of the group treated leaves one very largely in accord with the treatment given. However, in identifying *Carex sterilis* Willd. with *C. atlantica* Bailey it seems to the present writer that a mistake was made. The grounds for this view are the following:

(1) Both Willdenow and Schkuhr in their descriptions lay particular stress on the dioecious character of the spikes of the plant described by them, and in fact the name is taken from this character. *Carex atlantica* never to my knowledge shows this character, while on the other hand forms of *Carex Leersii* (*Carex stellulata*) do.

(2) *Carex atlantica* is a species of the coastal plain and is very rarely found inland. *Carex sterilis* was collected in Pennsylvania, probably near Lancaster, in a region where forms of *Carex Leersii* are very abundant.

The reason advanced by Professor Fernald for identifying *Carex sterilis* with *Carex atlantica* is chiefly that some of the original material has a broad and short-beaked perigynium as compared with the narrower and long-beaked perigynium of *Carex Leersii*. In this, however, this material agrees also with the recently described *Carex incomperta* Bicknell — a plant which, undoubtedly, is found around Lancaster, Pennsylvania, as it is not confined to the coastal plain.

Schkuhr's figure is based partly on young plants showing the dioecious character from which the name is taken and which should therefore be regarded as the type of the species, and partly on more mature plants showing broad short-beaked perigynia. The former seem to me to answer only to *Carex Leersii*, while the latter seem to me more probably referable to *C. incomperta* than to *C. atlantica*. Under the circumstances I would treat *Carex sterilis*, as a synonym of *Carex Leersii*, and maintain *Carex atlantica* and *C. incomperta* as valid species.

The genus Crataegus, with some theories concerning the origin of its species*

HARRY B. BROWN

Doubtless the genus *Crataegus* has puzzled systematic botanists more the past decade or two than has any other genus of phanerogamic plants. A number of careful workers have been studying the genus for several years but as yet only tentative conclusions have been reached.

In Gray's Field, Forest, and Garden Botany, published in 1857, there was listed for the states east of the Mississippi River, twelve species and two varieties of *Crataegus*. This included both wild and cultivated species. Ten species and four varieties were listed in the edition of Gray's Manual of Botany published in 1867. This included both wild species and species escaped from cultivation. In Chapman's Flora of the Southern United States, published in 1860, eleven species and one variety were described. These were largely the same as the species described in Gray's Manual, only three being different. In Coulter's Manual of the Botany of the Rocky Mountain Region, published in 1885, four species were described; two of these were included in Gray's Manual. In the Cayuga Flora, published in 1886, there were six species and one variety; this included the species of the Cayuga Lake basin. Focke's estimate in Engler & Prantl, Die Natürlichen Pflanzenfamilien, published in 1888, was that there were thirty to forty species growing in the north temperate zone. In the edition of Gray's Manual issued in 1889, there were only ten species and four varieties described. Chapman's Flora of the Southern United States, published in 1897, gives but fifteen species coming within its range, but about this time something happened to the genus, apparently — species seemed suddenly to become much more abundant. In Britton's Manual, issued in 1901, thirty-one species were described. This covered the northern states and extended westward to about the 100th meridian. In Small's Flora of the Southeastern United

* Contribution from the Department of Botany of Cornell University, No. 139.

States, published in 1903, one hundred and eighty-five species were described — an increase of one hundred and seventy in just six years, for Chapman, covering practically the same region, had fifteen in 1897. Sargent's Trees of North America, issued in 1905, contained descriptions of one hundred and thirty-two species having characters such that they can be called trees. This covered all of North America, north of Mexico.

During the past two years new works appeared — Britton's North American Trees and Gray's New Manual of Botany. The genus *Crataegus* was treated by W. W. Eggleston in both of these works. He favors the reduction of the number of species to the narrowest limits possible. In the work on trees, he lists fifty-one species large enough to be called trees, or tree-like in form; in Gray's New Manual, sixty-five species and about fifty varieties are described.

After devoting a limited amount of time to the study of the forms of the local flora of the Ithaca region, with the help of Mr. Eggleston and Mr. John Dunbar of Rochester, we have identified about thirty species and four or five varieties.

Prior to 1896, about one hundred North American species of *Crataegus* had been described; of these a large percentage are not tenable. Since 1896, eight hundred and sixty-six species and eighteen varieties have been described (most of them since 1900). The proposers of these are as follows:

E. L. Greene,	1 species.	
G. V. Nash,		1 variety.
J. K. Small,	1 species.	
A. A. Heller,	1 species.	
T. Howell,	1 species.	
C. H. Peck,	1 species,	1 variety.
J. H. Schuette,	1 species,	3 varieties.
F. Ramaley,	2 species.	
C. L. Gruber,	3 species,	2 varieties.
A. Nelson,	4 species.	
N. L. Britton,	8 species,	2 varieties.
W. W. Eggleston,	10 species,	3 varieties.
C. D. Beadle,	144 species.	
W. W. Ashe,	165 species.	
C. S. Sargent,	524 species,	6 varieties.

Many parts of the country have not yet been worked over thoroughly, and new descriptions are bound to appear for some time to come.

Species do not seem to be so abundant in western North America or in other parts of the world. Howell's Flora of Northwest America includes but two species; Jepson's Flora of Western Middle California, one; Rydberg's Flora of Colorado, but five; and the Coulter-Nelson New Manual of Botany of the Central Rocky Mountains, nine. There are about twelve species from the Rocky Mountains west, north of Mexico. Grisebach lists none in the Flora of the British West Indian Islands. In Bentham and Hooker's Genera Plantarum, but twelve species are said to be found in Europe, Asia, and Japan. It remains to be seen whether or not many more species will be found in these regions upon closer study.

A consideration of the foregoing facts brings up a number of interesting questions. Why did not the systematists discover the great number of species years ago? We cannot say they did not do careful work. Can it be that the number of species has multiplied greatly within the last few decades? Have the older species been hybridizing so that many of the forms at present are hybrids?

In order to get some light on some of these questions the following list of questions was sent to each of the following men, who are regarded as leading students of the genus in this country: C. S. Sargent, W. W. Eggleston, W. W. Ashe, C. D. Beadle, Ezra Brainerd, and John Dunbar.

1. Why did not the sytematic botanists discover the large number of species of *Crataegus* years ago?

2. Do you consider the species now being described elementary species?

3. Do the species breed true or come true to seed?

4. Will different species hybridize?

5. Do you consider the numerous species to have arisen as mutations?

Professor Sargent, director of the Arnold Arboretum, has perhaps devoted more time to the study of the genus than has any other man and has described many new species. In answer to the questions, he says:

1. Because they did not use their eyes and were satisfied to take for granted that what had been published about the genus was correct and final.

2. I do not know what you mean by elementary species.

3. We have planted in all nearly three thousand numbers of seeds at the Arboretum and so far have found no evidence that the different species do not come true from seed. In fact the seedlings of no other genus that has been raised here have shown such a remarkable resemblance to the parent plants.

4. We have never found here any evidence that the different species hybridize.

5. I cannot answer this question.

W. W. Ashe, of the Forest Service, U. S. Department of Agriculture, has studied East-American species of *Crataegus* considerably. His answers are:

1. The species of *Crataegus* were not recognized earlier because the material was studied entirely in a dry state, in which distinctive characters are very largely lost. It was not uncommon to find in the largest collections specimens of most different forms from widely separated parts of North America bearing the same name. Several groups even were not recognized; for example, *Intricatae*, all species of which were called "*coccinea*."

2. Some of the species now being proposed are undoubtedly elementary. Most of them, however, are certainly not. The 10- and 20-stamened forms with slight accompanying differences in fruit, or differences in anther color with slight accompanying differences in fruit are clearly elementary species. When differences extend to inflorescence, size of flowers, and foliage, the sum of the correlated characters may be regarded as entitling the form to full specific rank.

3. Many of the species are known to breed true through their seed. Most of them have not been sufficiently tested for conclusive proof.

4. Many species hybridize and some of those which have been proposed are undoubtedly hybrids. Hybrids are probably no more numerous, however, than between the nearly related species of American oaks. It is also undoubtedly true that some of the

species and groups based on the number of stamens are not valid, since I am now pretty sure that forms of some species may have either ten or twenty stamens.

5. Some of the species probably originated as mutations. The limit of fluctuating variation is undoubtedly wide in some groups, but there is frequently a correlation of characters in the species which in their stability suggests elementary species rather than more instable variation of mutation. Some of the forms in the *Molles* group, in Missouri and Illinois, would seem to be mutations, leading to the inference that some species of this group have originated in this manner. The variation in the *Pruinosae* in the Appalachians and the localized valley species also indicate mutation origin.

C. D. Beadle, director of the Biltmore Herbarium, at Biltmore, N. C., has made an extended study of southern forms of *Crataegus*. His answers are as follows:

1. It is necessary to know the complete history of the *Crataegus* species before an understanding of its status is possible. A parallel is well typified in the study of *Viola*, where a knowledge of the complete vegetative phases of each species must be understood in order to differentiate them. The earlier systematic botanists worked largely in the herbarium. The opportunity of dissolving the mysteries of the *Crataegus* genus may be gained only in the field and by studying groups of marked trees.

2. Yes and no. There is a large number of *Crataegus* species undoubtedly; and, no doubt, there is much duplicating in the specific publications by the different authors who are working altogether too independently of each other's discoveries.

3. Yes, I proved that they come true to seed before daring to publish a new species in this field.

4. Very probably they hybridize.

5. Yes, they are mutations.

W. W. Eggleston, of the New York Botanical Garden, is another distinguished student of the genus. He has studied the specimens in all of the larger herbaria of the country, the living plants in the different arboreta, and for a decade or more he has been making an extended study of plants in the field in various

parts of the country, especially in the eastern half of the United States. He, as was stated above, believes in reducing the number of species; he does this by making certain species of different authors equivalent, and by reducing other species to the rank of varieties. His discussion in regard to the questions is as follows:

Systematic botanists did not know the species in America largely because they never saw them. The Gray Herbarium and the Torrey Herbarium were both very scanty in *Crataegus*. The manuals took most of the forms they had. The coastal plain has very few *Crataegi*, and that is where a large share of the early collecting was done. The European botanical gardens had many more American species than were known here, and it is through them that the work commenced.

Crataegus plants produce much good seed and the plantations at Biltmore, Arnold Arboretum, and at the New York Botanical Garden, show that the forms of the genus reproduce themselves surprisingly from the seed (leaf characters only; trees mostly not yet fruiting). They doubtless will hybridize, and there are probably mutations, too.

Dr. Ezra Brainerd, ex-president of Middlebury College, Middlebury, Vt., was another authority questioned. He writes:

The queries that you raise in your letter of Nov. 15 regarding *Crataegus* are queries that have been puzzling me for over six years, and I am not even yet prepared to answer them with any positiveness. The problem is part of a larger one that I have been diligently studying as it is presented in the genus *Viola;* and here with very satisfactory results. Experimental work in *Crataegus* is difficult, as in this genus it is about 7 to 10 years from generation to generation: *Viola* affords a new generation each year. So I shall be able to give only brief and inadequate answers to your questions.

1. I fancy the systematic botanists did not "discover the large number of species of *Crataegus* years ago," because (*a*) they had broader conceptions of what constitutes a species than most modern botanists have; many recently made species used to be considered mere forms or varieties; (*b*) the genus *Crataegus*, I believe, has vastly increased in individuals and in "forms" in the northeastern U. S. since the forests were cut off; specimens are rarely found in the original forests of this region. But the plants rapidly take

possession of neglected pastures, fence-rows, and untilled ledges; (*c*) the older botanists had no time for the intensive study of a genus of numerous closely allied forms, such as *Crataegus*.

2. Many or most of "the large number of species now being described," if proper species at all, would have to rank as "elementary species." But some recently made species are, I believe, mere "fluctuations" or "forms."

3. I have never raised seedlings of *Crataegus;* Dr. Sargent has in large quantities, and he insists on it that as respects foliage they breed true to seed.

4. I must confess I have never attempted to hybridize *Crataegus* species; I know of no one who has attempted it with our American species. The few species of Europe cross in many ways (see Focke's Pflanzen-mischlinge, p. 146). I know of several cases of what appear to be natural hybrids, "local species," each quite intermediate between the two supposed parent species with which it is associated. The Rosaceae are of all orders most predisposed to hybridize. *Rosa*, *Rubus*, *Geum*, *Amelanchier*, and *Malus* are notorious for the forms resulting from interbreeding. By analogy we should expect the same condition of things in *Crataegus*. The array of closely allied forms (hardly distinguishable even by an expert) present a condition of things in *Crataegus* that is perfectly paralleled in *Rubus*, *Rosa*, and *Viola*. The multiplicity of even stable forms that may result (in the working out of Mendel's Laws) from one pair of parents is astonishing. The swarms of "elementary species," I suspect, have in some instances come about in this way.

5. There may be "mutations" in *Crataegus;* but it would be very hard to prove.

John Dunbar, of the Park Department, Rochester, N. Y., is another enthusiastic student of the genus. In answering the questions, he says:

1. No doubt they (the early systematists) believed honestly, without thorough investigation, that the large number of variations, which, of course, they could not help but detect, were mere forms of several species.

2. They are true species.

3. They do breed true. The progeny come with remarkable fidelity to the specific typical characters of the parents.

4. They may hybridize, but I have seen no evidence of it.

5. I have not given much attention to the conception of mutation in regard to the origin of species. It may be true. In the meantime I am inclined to believe in the Darwinian theory, that natural selection with other agencies, acting on varieties, and extending over a long period, has produced these *Crataegus* species, and all other species. The fact that the thorns are exceedingly hardy, virile, and distributed over a large area, and well fitted to maintain the struggle for existence, no doubt has given them a tendency to much variation, and in the course of many generations these inherited "traits" have become fixed and specific, and hence, new species, after a long lapse of time, appeared.

From studies, observations in the field, and what has been learned from special students of the genus as above set forth, we may arrive at certain tentative conclusions, which at least serve as working hypotheses.

There is no doubt that former systematists conceived of species as being much more composite than they are at present regarded by many. The Linnaean conception prevailed. In older herbaria we often find two quite distinct forms, forms now regarded as different species, mounted on one sheet; this may be taken as evidence of the broader conception of species that formerly prevailed.

Recent workers who have been studying species closely, especially students using the culture method, find that many systematic species are made up of a number of distinct forms, or elementary species that breed true when propagated by seed. A notable illustration of this is *Draba verna*, which has been studied by Jordan. In many of the descriptions of species of *Crataegus* recently offered, lines have been drawn so closely, forms separated by such fine distinctions that we doubtless have descriptions of elementary species. But this can be proved only by long culture experiments.

I am inclined to think that a great many of the *Crataegus* forms we have are hybrids. European species are known to hy-

bridize; species in several other genera of the rose family hybridize freely. During the spring of 1908, I pollinated a few *Crataegus monogyna* (English hawthorn) flowers with pollen from *C. Brainerdi*, a native species. They set fruit which matured. During the flowering season of 1909, Mr. William Moore and the writer made cross pollinations between the majority of the native species of the local flora. Most of these cross pollinations were effective, — fruit set and matured, being entirely normal apparently. (These experiments are still in progress, the details of which will be published later.)

Within the past few decades, since the primitive forests have been cleared away, there has been an immense increase in the number of *Crataegus* plants growing. Being low trees or shrubs they cannot thrive in dense forests but spread freely over open pastures and along fence rows. The pasture southeast of the campus of Cornell University, a field of some twenty or twenty-five acres, has at least a thousand plants. This field has been allowed to run to pasture for the last twenty-five years or more, and *Crataegi* have thriven well. The original forest was cleared away years ago. The increase in number of plants makes cross pollination easier and much more probable. Bees and other insects swarm about the trees when they are in blossom, going from flower to flower and from tree to tree.

Irregularity in the number of stamens and pistils, variation in the shape of the leaves on the plant, variation in the color of the anthers (colors ranging from nearly white to dark purple intergrade), and the occurrence of plants possessing characters found in two distinct species growing near by, may all be taken as evidence of hybridity or progressive species. Numerous local species is another indication. There is scarcely a state that has not some species not found elsewhere; many of the species found in this immediate locality are different from species found at Rochester.

The fact that *Crataegus* plants seem to come true to type when grown from seed is a stumbling block in the way of a hybridity theory. However, it is possible that *Crataegus* hybrids are stable and come true to type when grown from seed. It cannot be said that they have been tested thoroughly until many mature plants have been grown.

Some of the points just made may be taken as evidence of mutations, but the best known mutants are not as irregular in characters as many of the species of *Crataegus*. Cultures carried through several generations are necessary in order to test whether or not *Crataegus* species throw off mutants.

I am greatly indebted to the gentlemen mentioned for their kindness in answering my questions, and to W. W. Eggleston, especially for data concerning the number of species attributable to the different authors.

CORNELL UNIVERSITY,
ITHACA, NEW YORK

Two new seed-plants from the Lake Tahoe region, California

ERNEST A. MCGREGOR

Apocynum bicolor sp. nov.

Erect, 4–5 dm. high, wholly glabrous: lateral branches mostly shorter than the main stem and sterile: leaves spreading or somewhat ascending, deep green above, pale glaucous below, ovate-acute, cuspidate, the largest 6 cm. × 3.75 cm., the smaller 3.5 cm. × 2 cm., midvein almost white, prominent; petioles 3–5 mm. long: inflorescence usually a small dense terminal, often cymose panicle, considerably surpassed by the leaves, or occasionally with a similar but smaller panicle in one or two axils below; bractlets of the inflorescence minute, subulate: calyx campanulate, 3 mm. long, segments triangular-lanceolate, acute, with recurved tips, greenish, tinged with purple: flowers pale rose-tinged, cylindrical, 7 mm. long, the lobes finally spreading, narrowed but obtuse; tube 4 mm. long by 2.5 mm. wide: stamens 3.5 mm. long, the stout filaments half as long, densely pubescent, and half covered by the anthers, with a free, lacerate, terminal margin; anthers lanceolate, acute, 2.5 mm. long, the base deeply notched, with rather pointed inturned lobes; appendages between the stamens broadly ovate-turbinate, apiculate: stigma of two sessile oval lobes.

The type is *no. 32*, collected by the author Aug. 19, 1909, in Glen Alpine, near Lake Tahoe, California, growing in a meadow, alt. 2260 m.

This species is rather intermediate between the so-called *androsaemifolium* and *cannabinum* types (as they have been described by Greene, Pittonia **3**: 229). The erect habit of the plant and the cylindrical flowers belong to the *cannabinum* division, while the foliage characters and the color of the flowers belong to the other type.

When the Synoptical Flora, vol. 2, part 1, was issued, in 1878, only two species of *Apocynum* were recognized in North America, viz., *A. androsaemifolium* and *A. cannabinum*, and the distinction between them was none too marked. At the present date there are some thirty species recognized in North America, which as a rule are referred to one or the other of two groups based on these two

original species. The result is that a sort of "Apocynal chaos" obtains, such as we find existing in only too many of the so-called "tough groups." A serious treatment of the genus should be

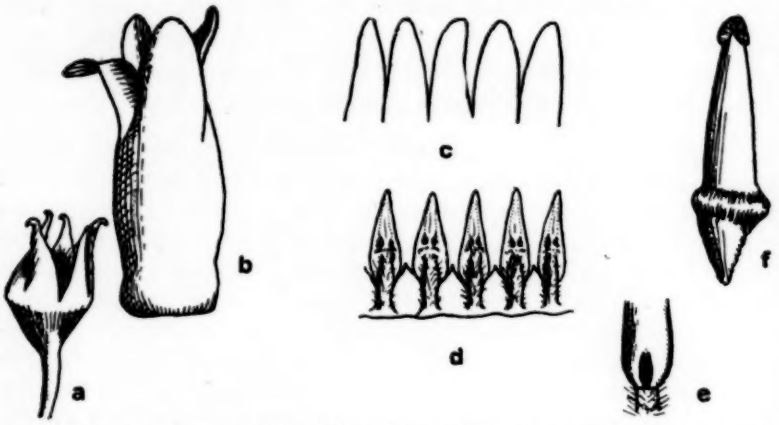

FIGURE 1. *Apocynum bicolor* McGregor; *a*, calyx, × 6; *b*, corolla, × 6; *c*, corolla lobes laid open, × 6; *d*, corolla tube laid open, exposing stamens and appendages, × 6; *e*, anther (outer view) to show basal lobes, × 9; *f*, pistil, showing stigma lobes × 11.

attempted, which I think might result in the reduction of several present-day species. The plant described above cannot be referred to any recognized species, and as its characters are fully as distinctive as those of any of the genus, I have felt justified in proposing it as the type of a new species.

Lappula Jessicae sp. nov.

Erect, simple to near the top, 5–7 dm. high, with short hirsute pubescence throughout, which is mostly spreading on the stems and petioles but appressed on the blades and inflorescence: leaves all entire and all surpassing the internodes, the blade always longer than the petiole; lower leaves oblong-oblanceolate, acutish or obtuse, gradually attenuate to the narrow-margined petioles, the largest 18 cm. long by 2.25 cm. wide; cauline leaves becoming sessile and broadly oblong-lanceolate and reduced above, even those of the inflorescence, however, quite ample and ovate-acuminate: inflorescence usually paniculately disposed but often quite flat-topped; peduncles simple, flowering to near the base, or more often once forked near the top, in which case the flowers are entirely restricted to these branchlets; pedicels at least equaling the calyx and recurved in fruit: calyx split nearly to the base, the

segments linear-oblong, obtuse, reflexed in fruit, about 3 mm. long : corolla sky-blue with whitish tube, the lobes rectangular, obtuse, 3 mm. long, about equaling the tube : corolla-appendages in outline acorn-shaped, broader than high ; appendage proper, corresponding to the cup, retuse above and densely short-papillate ; protuberance, corresponding to the acorn, rounded below and not projecting inward : anthers attached midway in the tube and just reaching to the appendages, oblong, 1 mm. long, with a broad hyaline irregular wing extending the full length of each angle, the filaments triangular-subulate, concealed by, and less than half as

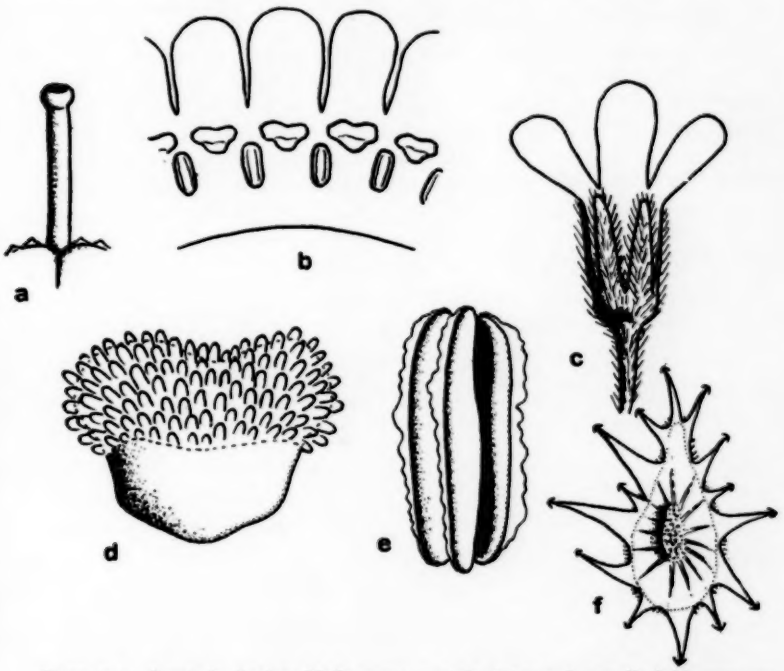

Figure 2. *Lappula Jessicae* McGregor ; *a*, style, × 10 ; *b*, corolla laid open, exposing anthers and appendages, × 6 ; *c*, single flower, × 5 ; *d*, corolla appendage, × 35 ; *e*, anther, showing hyaline wings, × 35 ; *f*, nutlet (ventral view), × 8.

long as the anthers : style comparatively short and stout ; stigma capitate, terminally indented : fruit secund, 5 mm. long ; nutlets ovate-acuminate, with about 10 marginal prickles and occasional smaller ones between, the larger prickles triangular-subulate, about 1.5 mm. long, all free to the base ; back of nutlets smooth except for minute sharp spines uniformly distributed and exactly resembling the individual barbs of the glochidiate prickles, and for 1 (or 2) glochidiate prickles on the middle of the keel ; ventral surface glabrous with elliptical central scar from which run radiating lines.

On wet ground, Half Moon Lake, near Lake Tahoe, California, Aug. 9, 1909, collected by the author, *no. 71*.

Of the *L. floribunda* type, perhaps nearest to *L. micrantha* Eastwood, but differing in the size of the flower, relative sizes of the perianth parts to one another, in relative size of anther to filament, and especially, perhaps, in the conspicuous wings of the anthers, as well as marked differences in the character of the nutlets.

Named in honor of my sister, who has assisted me greatly in the field.

Leland Stanford Junior University.

INDEX TO AMERICAN BOTANICAL LITERATURE

(1910)

The aim of this Index is to include all current botanical literature written by Americans, published in America, or based upon American material; the word America being used in its broadest sense.

Reviews, and papers which relate exclusively to forestry, agriculture, horticulture, manufactured products of vegetable origin, or laboratory methods are not included, and no attempt is made to index the literature of bacteriology. An occasional exception is made in favor of some paper appearing in an American periodical which is devoted wholly to botany. Reprints are not mentioned unless they differ from the original in some important particular. If users of the Index will call the attention of the editor to errors or omissions, their kindness will be appreciated.

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